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National Occupational Analysis

2012

Agricultural Equipment Technician

Human Resources and Skills Development Canada
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Agricultural Equipment Technician

2012

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FOREWORD

The Canadian Council of Directors of Apprenticeship (CCDA) recognizes this National Occupational Analysis (NOA) as the national standard for the occupation of Agricultural Equipment Technician.

Background

The first National Conference on Apprenticeship in Trades and Industries, held in Ottawa in 1952, recommended that the federal government be requested to cooperate with provincial and territorial apprenticeship committees and officials in preparing analyses of a number of skilled occupations. To this end, Human Resources and Skills Development Canada (HRSDC) sponsors a program, under the guidance of the CCDA, to develop a series of NOAs.

The NOAs have the following objectives:

- to describe and group the tasks performed by skilled workers;
- to identify which tasks are performed in every province and territory;
- to develop instruments for use in the preparation of Interprovincial Red Seal Examinations and curricula for training leading to the certification of skilled workers;
- to facilitate the mobility of apprentices and skilled workers in Canada; and,
- to supply employers, employees, associations, industries, training institutions and governments with analyses of occupations.

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This analysis was prepared by the Labour Market Integration Directorate of HRSDC. The coordinating, facilitating and processing of this analysis were undertaken by employees of the NOA development team of the Trades and Apprenticeship Division. The host jurisdiction of Saskatchewan also participated in the development of this NOA.

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To facilitate understanding of the occupation, the work performed by tradespersons is divided into the following categories:

Blocks	the largest division within the analysis that is comprised of a distinct set of trade activities
Tasks	distinct actions that describe the activities within a block
Sub-Tasks	distinct actions that describe the activities within a task
Key Competencies	activities that a person should be able to do in order to be called 'competent' in the trade

The analysis also provides the following information:

Trends	changes identified that impact or will impact the trade including work practices, technological advances, and new materials and equipment
Related Components	a list of products, items, materials and other elements relevant to the block
Tools and Equipment	categories of tools and equipment used to perform all tasks in the block; these tools and equipment are listed in Appendix A
Context	information to clarify the intent and meaning of tasks
Required Knowledge	the elements of knowledge that an individual must acquire to adequately perform a task

The appendices located at the end of the analysis are described as follows:

Appendix A – Tools and Equipment	a non-exhaustive list of tools and equipment used in this trade
Appendix B – Glossary	definitions or explanations of selected technical terms used in the analysis
Appendix C – Acronyms	a list of acronyms used in the analysis with their full name
Appendix D – Block and Task Weighting	the block and task percentages submitted by each jurisdiction, and the national averages of these percentages; these national averages determine the number of questions for each block and task in the Interprovincial exam
Appendix E – Pie Chart	a graph which depicts the national percentages of exam questions assigned to blocks
Appendix F – Task Profile Chart	a chart which outlines graphically the blocks, tasks and sub-tasks of this analysis

DEVELOPMENT AND VALIDATION OF ANALYSIS

Development of Analysis

A draft analysis is developed by a committee of industry experts in the field led by a team of facilitators from Human Resources and Skills Development Canada. This draft analysis breaks down all the tasks performed in the occupation and describes the knowledge and abilities required for a tradesperson to demonstrate competence in the trade.

Draft Review

The National Occupational Analysis (NOA) development team then forwards a copy of the analysis and its translation to provincial and territorial authorities for a review of its content and structure. Their recommendations are assessed and incorporated into the analysis.

Validation and Weighting

The analysis is sent to all provinces and territories for validation and weighting. Participating jurisdictions consult with industry to validate and weight the document, examining the blocks, tasks and sub-tasks of the analysis as follows:

BLOCKS	Each jurisdiction assigns a percentage of questions to each block for an examination that would cover the entire trade.
TASKS	Each jurisdiction assigns a percentage of exam questions to each task within a block.
SUB-TASKS	Each jurisdiction indicates, with a YES or a NO, whether or not each sub-task is performed by skilled workers within the occupation in its jurisdiction.

The results of this exercise are submitted to the NOA development team who then analyzes the data and incorporates it into the document. The NOA provides the individual jurisdictional validation results as well as the national averages of all responses. The national averages for block and task weighting guide the Interprovincial Red Seal Examination plan for the trade.

This method for the validation of the NOA also identifies common core sub-tasks across Canada for the occupation. If at least 70% of the responding jurisdictions perform a sub-task, it shall be considered common core. Interprovincial Red Seal Examinations are based on the common core sub-tasks identified through this validation process.

Definitions for Validation and Weighting

YES	sub-task performed by qualified workers in the occupation in a specific jurisdiction
NO	sub-task not performed by qualified workers in the occupation in a specific jurisdiction
NV	analysis Not Validated by a province/territory
ND	trade Not Designated in a province/territory
NOT COMMON CORE (NCC)	sub-task, task or block performed by less than 70% of responding jurisdictions; these will not be tested by the Interprovincial Red Seal Examination for the trade
NATIONAL AVERAGE %	average percentage of questions assigned to each block and task in Interprovincial Red Seal Examination for the trade

Provincial/Territorial Abbreviations

NL	Newfoundland and Labrador
NS	Nova Scotia
PE	Prince Edward Island
NB	New Brunswick
QC	Quebec
ON	Ontario
MB	Manitoba
SK	Saskatchewan
AB	Alberta
BC	British Columbia
NT	Northwest Territories
YT	Yukon Territory
NU	Nunavut

ANALYSIS

Safe working procedures and conditions, accident prevention, and the preservation of health are of primary importance to industry in Canada. These responsibilities are shared and require the joint efforts of government, employers and employees. It is imperative that all parties become aware of circumstances that may lead to injury or harm. Safe learning experiences and work environments can be created by controlling the variables and behaviours that may contribute to accidents or injury.

It is generally recognized that safety-conscious attitudes and work practices contribute to a healthy, safe and accident-free work environment.

It is imperative to apply and be familiar with the Occupational Health and Safety (OH&S) Acts and Workplace Hazardous Materials Information System (WHMIS) Regulations. As well, it is essential to determine workplace hazards and take measures to protect oneself, co-workers, the public and the environment.

Safety education is an integral part of training in all jurisdictions. As safety is an imperative part of all trades, it is assumed and therefore it is not included as a qualifier of any activities. However, the technical safety tasks and sub-tasks specific to the trade are included in this analysis.

SCOPE OF THE AGRICULTURAL EQUIPMENT TECHNICIAN TRADE

"Agricultural Equipment Technician" is this trade's official Red Seal occupational title approved by the CCDA. This analysis covers tasks performed by agricultural equipment technicians whose occupational title has been identified by some provinces and territories of Canada under the following names:

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
Agricultural Equipment Technician	✓	✓	✓	✓		✓	✓		✓	✓			
Agricultural Machinery Technician								✓					

Agricultural equipment technicians set up, maintain, service, diagnose, repair and recondition agricultural equipment. This equipment includes tractors and combines, as well as a variety of implements for agricultural functions such as tillage, seeding, planting, harvesting, haying, spraying and application. Agricultural equipment technicians may also work on outdoor power equipment. While they are involved in preventative maintenance, agricultural equipment technicians spend most of their time diagnosing and repairing malfunctioning or out of service equipment, either in the shop or in the field.

Agricultural equipment technicians must be able to service and repair gasoline and diesel engines, drive train systems and components, hydraulic, hydrostatic and pneumatic systems, electrical and electronic systems, steering and braking systems, structural components, operator station and other related support systems. They also assemble and adjust new agricultural equipment, perform scheduled maintenance service such as oil changes, lubrication and tune-ups, take defective units apart, and repair or replace broken, worn-out or faulty parts. Agricultural equipment technicians may specialize in certain types of equipment or in repairing one particular manufacturer's product line.

Agricultural equipment technicians must also have good communication and customer service skills, since they often interact with clients. They teach clients how to operate new equipment, discuss equipment operation, and consult with them to pinpoint problems and determine their specific needs.

Agricultural equipment technicians work in the agriculture sector for equipment manufacturers, dealerships and independent repair shops or on large farms. They can also be self-employed. The equipment they work on and the hours tend to change according to the season.

The work often requires considerable standing, climbing, crouching, balancing on equipment and heavy lifting. Technicians must be able to diagnose complex problems and interpret technical manuals and schematics.

Due to the size and complexity of the equipment, safety is of prime importance. Technicians must practice safe operating procedures and be conscious of the impact on people, equipment, work area and environment when performing their work. There is risk of serious injury when working with agricultural equipment.

This analysis recognizes similarities or overlaps with the work of automotive service technicians, truck and transport mechanics, heavy duty equipment technicians, small engine mechanics and welders.

With experience, agricultural equipment technicians may act as mentors and trainers to apprentices in the trade. They may also advance to become shop supervisors, service managers, sales people or manufacturers' service representatives. Some may also open their own dealerships or businesses.

Electronic systems and controllers are now standard on both new agricultural equipment and adapted to existing equipment. However, new emission control regulations have led to new technology developments in the engine control system. The complexity of the equipment has increased as a result of stringent emission standards.

New specialized diagnostic and testing tools such as laptop computers and engine analysis units are being used. The use of remote diagnostics through Global Positioning System (GPS), cellular and Bluetooth has become a trend. To increase machine efficiency, engine performance, and to decrease fuel consumption, the popularity of continuously variable transmissions (CVT) is rising.

Investments by clients on larger, quicker and more sophisticated multi-purpose equipment have increased. There are fewer investments in a number of smaller machines performing one task.

The technician's job is becoming more complex due to an increase in the complexity of equipment and diversification in the agricultural industry. Farming has become more efficient through the use of precision equipment. This has led to increased training requirements for technicians.

Individual dealerships are being purchased by larger organizations, creating multi-location dealerships. Technicians now service larger territories.

Environmental concerns such as soil conservation are on the rise. Eco-friendly equipment and bio fuels are becoming increasingly available. However, the viability of these options is still limited.

Essential skills are needed for work, learning and life. They provide the foundation for learning all other skills and enable people to evolve with their jobs and adapt to workplace change.

Through extensive research, the Government of Canada and other national and international agencies have identified and validated nine essential skills. These skills are used in nearly every occupation and throughout daily life in different ways.

A series of CCDA-endorsed tools have been developed to support apprentices in their training and to be better prepared for a career in the trades. The tools can be used independently or with the assistance of a tradesperson, trainer, employer, teacher or mentor to:

- understand how essential skills are used in the trades;
- learn about individual essential skills strengths and areas for improvement; and
- improve essential skills and increase success in an apprenticeship program.

The tools are available online or for order at: www.hrsdc.gc.ca/essentialskills.

The application of these skills may be described throughout this document within the competency statements which support each subtask of the trade. The following are summaries of the requirements in each of the essential skills, taken from the essential skills profile. A link to the complete essential skills profile can be found at www.red-seal.ca.

Reading
Agricultural equipment technicians read documents such as service bulletins, instruction and service manuals, brochures, pamphlets and work orders to diagnose problems, determine repairs and determine operation of machinery. They may also read farm periodicals to broaden their agricultural knowledge. They read safety related information such as Material Safety Data Sheets (MSDS) to learn how to safely handle hazardous materials.

Document Use
Documents that agricultural equipment technicians work with include work orders, checklists, and service manuals. They also consult and interpret a variety of graphs, charts and technical drawings such as tables, sketches and schematics.

Writing
Agricultural equipment technicians write detailed notes and descriptions about jobs. They must write detailed notes to keep records of their observations and recommendations for themselves, manufacturers, colleagues and clients.

Numeracy
Agricultural equipment technicians use numeracy skills to take a variety of measurements such as tolerances, rates of flow and pressure. They also calculate perimeters, volumes and areas. They may estimate and calculate labour time to prepare repair quotes and invoices.

Oral Communication
Agricultural equipment technicians use oral communication skills to discuss job details with colleagues, apprentices, manufacturers and clients. They need the ability to translate technical information to common terms. They may also instruct and instil understanding and knowledge of equipment to clients when assisting in setting up new machines.

Thinking Skills
Problem solving skills are used by agricultural equipment technicians to diagnose the cause of problems. Agricultural equipment technicians use decision making skills to decide the course of action to recommend after identifying the problem. They plan and organize their work in order to accomplish their tasks efficiently.

Digital Technology
Agricultural equipment technicians use databases to access customer information, specifics of previously completed work and details on parts information and prices. They use communications software such as email to exchange information with manufacturers, colleagues and clients. They use diagnostic equipment that runs software applications and codes to determine operational data. They may access specifications, technical drawings and training materials through the Internet, CDs and DVDs.

Working with Others
Agricultural equipment technicians mostly work independently but they may seek advice and assistance from other technicians. At farm sites, they work in close communication with the client.

Continuous Learning
Agricultural equipment technicians learn by talking to colleagues, manufacturers and service managers and by reading trade specific publications, operators manuals and repair manuals. They read bulletins about new products and specific problems. They may attend in-house presentations or training from manufacturers. They also continuously learn through a variety of work experiences.

Trends The enforcement of safety regulations continues to increase. Manufacturers are making equipment safer to work with by adding features such as ladders, hand rails and operator presence switches.

Related Components All components apply.

Tools and Equipment See Appendix A.

Task 1 Performs safety-related functions.

Context Agriculture equipment technicians must adhere to safety procedures and regulations when using personal protective equipment (PPE) and safety equipment. Maintaining a safe work environment is also critical.

Required Knowledge

K 1	types of PPE such as respiratory, hearing, sight and body protection
K 2	types of safety equipment such as caging devices, shop ventilation, eye wash station and first aid kit
K 3	PPE and safety equipment operations
K 4	emergency phone numbers
K 5	environmental handling, disposal and recycling procedures for materials such as antifreeze, oil and refrigerants
K 6	workplace safety and health regulations such as WHMIS and OH&S
K 7	company policies and procedures such as evacuation routes, location of safety equipment, emergency exits and safety training

Sub-task

A-1.01 Uses personal protective equipment (PPE) and safety equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

A-1.01.01	select and use PPE such as safety glasses, boots and coveralls according to company policy and operation
A-1.01.02	select and use safety equipment such as fire extinguishing equipment, first aid stations and eye wash stations according to operation
A-1.01.03	organize and store PPE and safety equipment in designated areas
A-1.01.04	report worn, damaged and defective PPE and safety equipment

Sub-task

A-1.02 Maintains safe work environment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

A-1.02.01	maintain clean work area free of hazards such as trip hazards and oil spills
A-1.02.02	perform lock-out procedures according to work environment and type of equipment
A-1.02.03	handle, store and dispose of hazardous materials such as chemicals, refrigerants, and high pressure gases and fluids according to jurisdictional regulations
A-1.02.04	verify clear line of sight and area is clear of obstructions before equipment operation by performing activities such as a walk around of area and equipment

Task 2 — Performs common work practices and procedures.

Context Work procedures in this task are common activities which may be performed throughout this trade. Agriculture equipment technicians must adhere to safety procedures and regulations when performing these tasks.

Required Knowledge

K 1	jurisdictional licensing regulations
K 2	optimal performance of equipment
K 3	types of lubricants such as synthetic and non-synthetic
K 4	consequences of mixing types of fluids, lubricants and coolants
K 5	types of filters such as wash-out and pre-cleaners
K 6	application of filters such as air, fuel and oil
K 7	disposal and recycling of oil, antifreeze, a/c refrigerant, contaminated fuels and filters
K 8	types of hoses, tubing and fittings such as plastic, rubber, neoprene and steel
K 9	types of bearings/bushings
K 10	types of seals such as static and dynamic
K 11	application of bearings/bushings and seals
K 12	types of fasteners such as locking washers, lock nuts and torque to yield bolts and their applications
K 13	types of sealing devices, adhesives and gaskets and their applications
K 14	torque specification of fasteners
K 15	taps, dies and thread repair kits
K 16	anaerobic locking materials and their applications
K 17	cleaning solutions and solvents
K 18	cleaning requirements for components
K 19	company policies and procedures such as using work orders and checklists
K 20	time management
K 21	sequencing of jobs

Sub-task

A-2.01 Conducts operational tests.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

A-2.01.01	operate equipment and attachments to verify operation according to application, environmental conditions and original equipment manufacturer (OEM) specifications
A-2.01.02	perform sensory inspections for faults such as damage, improper adjustments or improperly installed attachments
A-2.01.03	interpret results of operational test to identify symptoms of problems or repairs required

Sub-task

A-2.02 Maintains fluids, lubricants and coolants.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

A-2.02.01	select and use hand tools such as filter wrenches, filter cart and funnels according to operation
A-2.02.02	verify fluid levels such as transmission, coolant, differential and hydraulic levels
A-2.02.03	select types and grades of fluids and lubricants for the application
A-2.02.04	perform sensory inspections such as visual or odour to determine if fluids have been mixed improperly
A-2.02.05	test coolant sample and interpret pH level results
A-2.02.06	interpret test results of liquids such as engine and hydraulic oil for symptoms of wear or failure of components
A-2.02.07	drain, refill or top up fluids according to required levels, OEM specifications and service intervals

Sub-task

A-2.03 Services filters.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

A-2.03.01	locate filters for components such as engines, hydraulics, transmission, cab and differentials
A-2.03.02	select and use tools and equipment such as filter wrenches and square drives according to operation
A-2.03.03	perform visual inspection of filters for faults such as plugged or damaged filters
A-2.03.04	relieve pressure from air and fluids before removing filters
A-2.03.05	clean or replace filters according to filter condition, OEM specifications and service intervals

Sub-task

A-2.04 Maintains hoses, tubing and fittings.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

A-2.04.01	relieve pressure from air and fluid systems before disconnecting hoses, tubing and fittings
A-2.04.02	perform visual inspections of hoses, tubing and fittings for faults such as holes, cracks and breakage
A-2.04.03	select and use tools and equipment such as hand tools and hydraulic hose crimpers according to operation
A-2.04.04	replace hoses, tubing and fittings according to OEM specifications, pressure limits and fluid being used
A-2.04.05	repair or construct hose/tube assemblies

Sub-task

A-2.05 Services bearings/bushings and seals.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

A-2.05.01	install wear sleeves
A-2.05.02	select and use tools and equipment such as bearing seal drivers and hand tools according to operation
A-2.05.03	perform inspections of bearings/bushings, seals and shafts for faults such as wear and damage
A-2.05.04	lubricate bearings/bushings and seals
A-2.05.05	replace bearings/bushings and seals
A-2.05.06	adjust bearings/bushings to allowable tolerance according to OEM specifications

Sub-task

A-2.06 Uses fasteners, sealing devices, adhesives and gaskets.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

A-2.06.01	select sealing or gasket material according to application
A-2.06.02	replace sealing devices, sealants, adhesives and gaskets according to application
A-2.06.03	replace fasteners according to grade, thread pitch and size
A-2.06.04	construct gaskets
A-2.06.05	repair threads by actions such as re-threading and thread insert
A-2.06.06	select and use tools and equipment such as taps, dies, chasers and thread inserts according to application

Sub-task

A-2.07 Cleans components.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

A-2.07.01	select and use cleaning tools such as parts washers, scrapers, pressure washers, compressed air and wire wheels according to application
A-2.07.02	select cleaning method such as scraping, wiping, washing and compressed air according to type and location of repair
A-2.07.03	select cleaning solution or solvents such as brake cleaner and electrical contact cleaner
A-2.07.04	verify area surrounding component is clean and clear of debris before component removal
A-2.07.05	verify component has been cleaned

Sub-task

A-2.08 Verifies equipment and component repairs.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

A-2.08.01	select and use tools and equipment such as ammeters, pressure gauges, dial indicators and multi-meters according to application
A-2.08.02	verify component operation such as starters, gear boxes and injectors before re-installation
A-2.08.03	perform tests such as amp draw, voltage, pressure, flow and end-play on repaired components
A-2.08.04	verify that dimensions/pressures are correct according to OEM specifications
A-2.08.05	perform sensory inspections to verify repair
A-2.08.06	operate equipment and attachments to verify operation according to application, environmental conditions and OEM specifications
A-2.08.07	interpret results of operational test to confirm repair is complete
A-2.08.08	advise operator of required follow-up procedures such as re-torques, fluid top-ups and break-in periods

Sub-task

A-2.09 **Plans daily tasks.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

A-2.09.01	determine priorities of tasks according to factors such as logical and efficient sequence, and availability of parts
A-2.09.02	estimate repair times and finish dates
A-2.09.03	determine required materials and tools for diagnostics and repairs on service calls
A-2.09.04	organize travel schedule efficiently

Sub-task

A-2.10 **Performs failure analysis.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

A-2.10.01	consult customer or operator to identify factors such as point and time of failure
A-2.10.02	consult factory assistance for items such as service bulletins and special procedures to isolate cause of failure
A-2.10.03	analyze systems according to OEM theory of operation needed to isolate cause of failure
A-2.10.04	recommend required repair according to the root cause of failure

Task 3 — Uses and maintains tools and equipment.

Context Agriculture equipment technicians must use tools and equipment to perform all tasks in their trade. Handling tools and equipment also includes maintenance.

Required Knowledge

K 1	types of hand tools
K 2	operating procedures
K 3	imperial and metric systems
K 4	types of power tools such as pneumatic, hydraulic and electrical tools
K 5	basic repairs of power tools
K 6	OEM maintenance specifications such as lubrication and calibration schedules
K 7	measuring devices such as micrometers, calipers and tape measures
K 8	testing devices such as pressure gauges, flowmeters and temperature gauges
K 9	diagnostic tools and equipment such as computers, multimeters and handheld diagnostic tools
K 10	types of welding/cutting equipment
K 11	jurisdictional regulations such as hoisting and lifting
K 12	types of staging equipment such as axle stands and blocking
K 13	load limitations of staging equipment and supporting devices
K 14	types of hoisting, lifting and securing equipment such as forklifts, jacks, and chain/vehicle hoists
K 15	applications and limitations of hoisting, lifting and securing equipment
K 16	operation of computerized diagnostic tools and equipment such as laptops and handheld devices
K 17	manufacturers' programming procedures

Sub-task

A-3.01 Maintains tools and equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

A-3.01.01	organize and store tools and equipment in designated areas
A-3.01.02	repair or replace worn, damaged or faulty tools and equipment
A-3.01.03	report or dispose of worn, damaged or faulty tools and equipment
A-3.01.04	sharpen tools and equipment such as drill bits and scrapers
A-3.01.05	calibrate measuring, testing and diagnostic tools and equipment
A-3.01.06	transport welding/cutting equipment according to the Transportation of Dangerous Goods (TDG) Act
A-3.01.07	lubricate and clean tools and equipment

Sub-task

A-3.02 Uses hoisting, lifting and securing equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

A-3.02.01	select hoisting, lifting and securing equipment according to application
A-3.02.02	interpret tags identifying load limits on equipment such as overhead hoists, chains, slings, tie down straps and shackles
A-3.02.03	identify safe lifting locations or points, and weight according to OEM specifications
A-3.02.04	identify, report and dispose of worn, damaged and faulty hoisting, lifting and securing equipment according to jurisdictional regulations
A-3.02.05	identify potential hazards such as ceiling heights, overhead wires and uneven surfaces and implement measures to minimize risk
A-3.02.06	operate hoisting, lifting and securing equipment according to OEM specifications

Sub-task

A-3.03 Uses computers for diagnostics and programming.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

A-3.03.01	use software applications such as OEM diagnostic and operating software, and the internet based technical support
A-3.03.02	verify software version and download from manufacturer and upload to controllers
A-3.03.03	select and use tools and equipment such as laptops, datalinks and OEM communication devices according to application
A-3.03.04	download and print reports from equipment controller and forward to OEM or customer
A-3.03.05	interpret diagnostic results and reports to determine failure and required repair

BLOCK B ENGINES AND ENGINE SUPPORT SYSTEMS

Trends

There is a movement from mechanical engine management to complete electronic controlled management and technicians need to continually adapt to new technology. Communication between different systems through the engine management system allows for more application options and enhanced performance to meet emission standards. The complexity of emission control systems is increasing due to the California Air Research Board (CARB) and Environmental Protection Agency (EPA). Failures in emission control systems are contributing to increased failures of base engine components. To minimize contamination of fuel, storage and maintenance practices are becoming more critical because the newer fuel systems have tighter tolerances and higher operating pressures.

Related Components (including, but not limited to)

Base engine: valves, pistons, connecting rods, blocks, cylinder heads, crankshaft, camshaft, counterbalance system, timing gears.

Lubrication system: oil filter, oil pan, cooling nozzles, oil pump, coolers, lube lines, pressure regulating devices.

Cooling system: water pump, external coolers, hoses, thermostat, radiator, fan drives, fan shrouds.

Intake/exhaust system: turbo chargers, intake pre-cleaners, intake and exhaust manifolds, gaskets, intercoolers, aftercoolers, mufflers, exhaust gas recirculation (EGR) system, waste gate exhaust system, selective catalytic reduction (SCR) systems, diesel particulate filter (DPF), diesel oxidation catalyst (DOC).

Fuel delivery system: pumps, injectors, tanks, check valves, lines, filters, water separators, regulators.

Engine management system: controllers, sensors, solenoids, switches, harnesses.

Tools and Equipment

See Appendix A.

Task 4 — Diagnoses engine and engine support systems.

Context The proper diagnosis of engines and supporting systems is critical to ensure optimum engine performance, efficiency and emission compliance. Agricultural equipment technicians need to understand the complexity of the engine and related systems that affect its operation.

Required Knowledge

K 1	base engine components such as valves, pistons and blocks
K 2	theory of engine operation
K 3	lubrication system components such as oil filters, oil pump, coolers, lube lines and pressure regulating devices, and their operation
K 4	fluid classifications such as viscosity, American Petroleum Institute (API) and Society of Automotive Engineers (SAE) classifications
K 5	inspection and testing procedures such as pressure tests
K 6	cooling system components such as water pump, thermostats, radiator and fan drives, and their operation
K 7	air cooling systems and components such as fins and air ducting
K 8	radiator cap relief pressure
K 9	coolant classifications and additives
K 10	hazards of pressurized cooling systems
K 11	intake/exhaust system components such as turbochargers, intake pre-cleaners, intake and exhaust manifolds, gaskets, coolers, mufflers and emission control systems
K 12	starting aids such as pre-heaters, ether injection and glow plugs
K 13	air flow problems
K 14	types of fuel delivery systems such as mechanical and electronically controlled
K 15	fuel delivery system components such as pumps, injectors, tanks, check valves and lines, and their operation
K 16	types of fuels such as winter, summer and bio-fuel
K 17	types of fuel additives
K 18	engine management system components such as controllers, sensors, solenoids and harnesses
K 19	operation, design and function of engine management and emission control systems
K 20	electronic schematics

Sub-task

B-4.01 Diagnoses base engine.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

B-4.01.01	consult with customer or operator to identify symptoms of problem
B-4.01.02	perform visual and auditory inspections to check for faults such as intake, exhaust and fluid leaks, and abnormal noises
B-4.01.03	select and use tools and equipment such as temperature measuring devices, compression testers and measuring instruments according to application
B-4.01.04	remove components such as panel, shields and hoods for access
B-4.01.05	perform tests for compression, bearing clearance and crankshaft end-play
B-4.01.06	interpret test results and compare to OEM specifications
B-4.01.07	determine required actions such as repairs, component replacement of crankshaft bearings, pistons and liners, head gaskets and camshafts, or further diagnoses

Sub-task

B-4.02 Diagnoses lubrication system.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

B-4.02.01	consult with customer or operator to identify symptoms of problem
B-4.02.02	perform sensory inspections of engine oil for colour, level, viscosity and odour
B-4.02.03	select and use tools and equipment such as pressure gauges and dyes according to application
B-4.02.04	locate source of contamination such as coolant or fuel
B-4.02.05	test oil pressure and interpret results according to OEM specifications
B-4.02.06	check for failed, worn, damaged or faulty components such as oil pump, oil cooler and pressure regulator valves

B-4.02.07	interpret engine oil test results to determine engine wear or fluid contamination
B-4.02.08	determine required actions such as repairs, component replacement or further diagnoses

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Sub-task

B-4.03 Diagnoses cooling system.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

B-4.03.01	consult with customer or operator to identify symptoms of problem
B-4.03.02	perform sensory inspections of coolant for contamination by checking colour, level and odour
B-4.03.03	locate source of contamination such as oil or fuel
B-4.03.04	select and use tools and equipment such as pressure testers, refractometers and temperature measuring devices according to application
B-4.03.05	use test strips to determine overall coolant condition such as PH level and freeze point
B-4.03.06	check components such as water pump, oil cooler, thermostats, cooling fan and radiator for faults such as leakage, blockages, erosion, wear and oxidization
B-4.03.07	determine required actions such as repairs, component replacement and radiator flush, or further diagnoses

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Sub-task

B-4.04 Diagnoses intake and exhaust system.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

B-4.04.01	consult with customer or operator to identify symptoms of problem
B-4.04.02	perform visual inspections of components such as filters for contamination, intake and exhaust components for leaks, and turbochargers for wear

B-4.04.03	select and use tools and equipment such as pressure gauges and pyrometers according to application
B-4.04.04	perform specialized intake testing procedures such as boost pressures, intake air temperatures and exhaust temperatures
B-4.04.05	test components such as cold weather starting aids, grid heaters and turbo charger actuators
B-4.04.06	determine required actions such as repairs, component replacement and adjustments, or further diagnoses

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Sub-task

B-4.05 Diagnoses fuel delivery system.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

B-4.05.01	consult with customer or operator to identify symptoms of problem
B-4.05.02	perform visual inspections of components such as injection pumps, lines and injectors for leaks, and filters for air ingress and water deposits
B-4.05.03	perform auditory inspections for abnormal noises such as combustion detonation or misfiring
B-4.05.04	select and use tools and equipment such as pressure gauges, vacuum gauges and flowmeters according to application
B-4.05.05	interpret fuel system flow schematics to determine system function and component location
B-4.05.06	perform operational tests such as injector cut-out, injector operation and injection pump timing test using OEM specialty tools to identify faulty components
B-4.05.07	check components such as transfer pumps, injectors, filter heads, fuel piping and main injection pump components for faults such as wear and damage
B-4.05.08	determine required actions such as repairs, component replacement, and static injection pump timing adjustment, or further diagnoses

Sub-task

B-4.06 Diagnoses engine management systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

B-4.06.01	consult with customer or operator to identify symptoms of problem
B-4.06.02	select and use electronic diagnostic tools and equipment such as laptops handheld devices, break-out harnesses and multimeters according to application
B-4.06.03	monitor system operation and interpret results such as abnormal temperature, pressure and speed readings to determine faulty components according to OEM diagnostic practices
B-4.06.04	determine required repair such as sensor, actuator and or controller replacement or adjustment, or further diagnoses

Sub-task

B-4.07 Diagnoses emissions control systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

B-4.07.01	consult with customer or operator to identify symptoms of problem
B-4.07.02	select and use electronic diagnostic tools and equipment such as laptops, break-out harnesses, temperature measuring devices and multimeters according to application
B-4.07.03	perform visual inspection of diesel exhaust fluid (DEF) delivery and storage components for leaks
B-4.07.04	perform visual inspection of EGR, DPF and DOC for physical damage
B-4.07.05	interpret diagnostic tests to identify improperly operating components such as plugged DPF and plugged DOC
B-4.07.06	interpret diagnostic tests to identify improperly operating components such as plugged DEF injection nozzle and malfunctioning dosing module
B-4.07.07	determine required repair such as sensor, actuator and or controller replacement, emission control system regeneration, or further diagnoses

Task 5 — Repairs engine and engine support systems.

Context

The effective repair of engines and engine support systems is critical to engine performance, reliability and emission compliance. The engine is the vital part of the machine, as it is the power source for all operations. Agricultural equipment technicians must possess a thorough understanding of these systems.

Required Knowledge

K 1	base engine components such as cylinder heads, pistons and blocks
K 2	theory of engine operation
K 3	lubrication system components such as oil filters, oil pump, coolers, lube lines and pressure regulating devices and their operation
K 4	fluid classifications such as viscosity, API and SAE classifications
K 5	cooling system components such as water pump, thermostats, radiator and fan drives, and their operation
K 6	air cooling systems and components such as fins and air ducting
K 7	hazards of pressurized cooling systems
K 8	intake/exhaust system components such as turbo chargers, intake pre-cleaners, intake manifold gaskets, coolers, mufflers and emission control systems
K 9	starting aids such as pre-heaters, ether injection and glow plugs
K 10	types of fuel delivery systems such as mechanical and electronically controlled, and their operation
K 11	fuel delivery system components such as pumps, injectors, tanks, check valves and lines
K 12	types of fuels such as winter, summer and bio-fuel
K 13	types of fuel additives
K 14	engine management system components such as controllers, sensors, solenoids and harnesses
K 15	operation, design and function of engine management and emission control systems

Sub-task

B-5.01 **Repairs base engine.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

B-5.01.01	prepare machine for engine removal and re-installation by performing functions such as removing and re-installing hoods, panels and electrical connections
B-5.01.02	select and use tools and equipment such as torque wrenches, dial indicators and measuring instruments according to application
B-5.01.03	measure components such as crankshafts and balancer shafts for wear to determine suitability for reconditioning
B-5.01.04	adjust components such as valves for valve clearance and liners for suitable protrusion
B-5.01.05	rebuild engine by replacing components such as head gaskets, main and rod bearings, crankshaft seals and o-rings to fix conditions such as leaks and wear to meet OEM specifications
B-5.01.06	perform break-in procedure according to OEM specifications to increase engine life and reliability

Sub-task

B-5.02 **Repairs lubrication system.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

B-5.02.01	remove components such as panel, shields and hoods for access to repair area
B-5.02.02	select and use tools and equipment such as torque wrenches and OEM special tooling according to application
B-5.02.03	replace worn or damaged components such as oil pump, oil cooler and pressure regulating valves according to OEM specifications
B-5.02.04	reassemble unit after repair

Sub-task

B-5.03 **Repairs cooling system.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

B-5.03.01	remove components such as panel, shields and hoods for access to repair area
B-5.03.02	select and use tools and equipment such as torque wrenches and OEM special tooling according to application
B-5.03.03	replace worn or damaged components such as water pump, bearings and impellers according to OEM specifications
B-5.03.04	flush or replace blocked radiator
B-5.03.05	verify thermostat operation before installation
B-5.03.06	clean and blow out blockages to ensure adequate air flow in air-cooled systems
B-5.03.07	blow out external radiator blockages
B-5.03.08	reassemble unit after repair

Sub-task

B-5.04 **Repairs intake and exhaust system.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

B-5.04.01	remove components such as panel, shields and hoods for access to repair area
B-5.04.02	select and use tools and equipment such as torque wrenches and OEM special tooling according to application
B-5.04.03	replace worn or damaged components such as turbochargers, intake piping, pre-cleaners and charge air coolers according to OEM specifications
B-5.04.04	adjust components such as waste gate for travel, and intake and exhaust valve clearances
B-5.04.05	identify components such as turbochargers and cylinder heads for reconditioning
B-5.04.06	reassemble unit after repair

Sub-task

B-5.05 **Repairs fuel delivery system.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

B-5.05.01	remove components such as air ducting, valve covers and surge tank to access repair area
B-5.05.02	select and use tools and equipment such as torque wrenches and OEM special tooling according to application
B-5.05.03	replace worn or damaged components such as transfer pumps, injectors, filter heads, fuel piping and main injection pump according to OEM specifications
B-5.05.04	adjust components such as injectors and injection pump static timing according to OEM specifications
B-5.05.05	inspect components such as injection pump and injectors for reconditioning
B-5.05.06	adjust components such as shimming mechanical injectors and calibrating electronic injectors
B-5.05.07	bleed fuel system for operation
B-5.05.08	reassemble unit after repair

Sub-task

B-5.06 **Repairs engine management systems.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

B-5.06.01	remove components such as panels, shields and hoods to access repair area
B-5.06.02	replace components such as harnesses, actuators, connectors, controllers, switches and sensors
B-5.06.03	repair components such as connector pins and wires
B-5.06.04	recalibrate components such as sensors and switches according to OEM specifications
B-5.06.05	select and use tools and equipment such as laptops, handheld devices, multimeters and terminal release tools according to application
B-5.06.06	reassemble unit after repair

Sub-task

B-5.07 **Repairs emissions control systems.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

B-5.07.01	remove components such as hoods, panels, heat shields and covers to access repair area
B-5.07.02	select and uses tools and equipment such as OEM special tools and OEM approved lifting devices according to application
B-5.07.03	replace components such as DPF, DOC, DEF, sensors and actuators
B-5.07.04	perform parked regenerative cycle for DPF and DOC
B-5.07.05	reassemble unit after repair
B-5.07.06	verify new DPF and DOC has appropriate controller software

BLOCK C — DRIVE TRAIN

Trends

Drive trains are becoming more complex and efficient resulting in less operator input to complete the task. The introduction of new technology increases the difficulty for the agricultural equipment technician to diagnose and repair the drive train. Dry clutches are being reintroduced in some markets because they are cost effective. More applications are being found for CVT or infinite variable transmissions (IVT).

Related Components (including, but not limited to)

Clutches: discs, centre plates, release springs, bearings, pressure plates, pistons, seals.

Driveline systems: drive shaft, u-joints (cross kits), constant velocity (CV) joints, yokes, slip-joints, seals, steady bearings (hanger bearings), support brackets, grease nipples, chains, sprockets, belts, sheaves.

Transmissions and gear cases: seals, gaskets, gears, bearings, breathers, filters, oil pumps, shafts, planetaries, connectors, torque converters, coolers, valve bodies, clutch packs, wiring, solenoids, controllers, shift rails, shift lever and knob, cylinders, sensors.

Differentials: seals, breathers, axles, gaskets, hubs, shafts, gears, planetaries, bearings, shift forks, filters, coolers, locking devices, sensors, wiring, solenoids, clutch packs.

Tools and Equipment

See Appendix A.

Task 6 — Diagnoses drive train.

Context

The drive train of agricultural equipment consists of components that transfer power from the engine to the ground in the form of motion. The drive train allows for different speed and directions.

The agricultural equipment technician performs a diagnostic analysis to identify the cause of failure to the drive train and its components.

Required Knowledge

K 1	types of clutches such as push, pull, wet and dry
K 2	clutch failures
K 3	driveline systems such as belts, chains and shafts

K 4	driveline components such as sprockets, bearings and u-joints
K 5	types of transmissions such as gear, power shift and variable transmissions
K 6	operational characteristics
K 7	types of gear cuts such as bevel, helical and straight
K 8	types of gear cases such as reduction, planetary and directional change
K 9	types of bearings such as ball, tapered roller and needle
K 10	types of differentials such as hypoid, amboid and spiral bevel
K 11	differential applications
K 12	differential components such as bearings, bushings and seals
K 13	differential locking systems
K 14	transmission hydraulic systems
K 15	crown and pinion wear patterns

Sub-task

C-6.01 Diagnoses dry clutches.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

C-6.01.01	consult with customer or operator to identify symptoms of problems
C-6.01.02	operate equipment to test clutch operation for faults such as slipping and dragging
C-6.01.03	perform visual and auditory inspections to identify faults such as wear, adjustment and abnormal noises
C-6.01.04	determine required actions such as repairs, component replacement or further diagnoses

Sub-task

C-6.02 Diagnoses driveline systems and components.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

C-6.02.01	consult with customer or operator to identify symptoms of problems
C-6.02.02	operate equipment to test driveline systems for faults such as slipping, vibration and abnormal noises
C-6.02.03	select and use diagnostic tools and equipment such as temperature measuring devices, hand tools and stethoscope according to application
C-6.02.04	perform inspections such as checking bearing temperature and measuring clutch pedal free play
C-6.02.05	perform visual inspections on components such as torque plate, drive shafts, u-joints, sliding couplers and steady bearings (hanger bearings) for faults such as excessive play, breakage and wear
C-6.02.06	determine required actions such as repairs, component replacement or further diagnoses

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Sub-task

C-6.03 Diagnoses wet clutches, transmissions and gear cases.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

C-6.03.01	consult with customer or operator to identify symptoms of problems
C-6.03.02	operate equipment to test transmissions systems for faults such as slipping, vibration and abnormal noise
C-6.03.03	operate equipment to identify probable causes of symptoms
C-6.03.04	perform diagnostic checks such as pressure checks, electrical tests, service codes and synchronizer tests
C-6.03.05	disassemble the transmission to determine probable causes of failure such as internal leaks, factory defects and damaged piston seals or sealing rings
C-6.03.06	determine required actions such as repairs, component replacement, or further diagnoses

Sub-task

C-6.04 Diagnoses differentials and final drives.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

C-6.04.01	consult with customer or operator to identify symptoms of problems
C-6.04.02	operate equipment to test differential systems for symptoms such as vibrations, abnormal noises and uncharacteristic operation
C-6.04.03	perform sensory inspections to identify faults such as wear and oil contamination, and abnormal odours
C-6.04.04	select and use diagnostic tools and equipment such as pressure gauges, jacks and dial indicators according to application
C-6.04.05	determine required actions such as repairs, component replacement or further diagnoses

Task 7 Repairs drive train.

Context Agricultural equipment technicians repair drive trains by removing, reconditioning, replacing, installing and adjusting various components of the equipment.

Required Knowledge

K 1	types of clutches such as push, pull, wet and dry
K 2	clutch components such as pressure plate, flywheel and disc
K 3	removal and assembly procedures for various types of equipment according to OEM specifications
K 4	driveline systems such as belts, chains and shafts
K 5	driveline components such as sprockets, bearings and u joints
K 6	types of transmissions such as gear, power shift and variable transmissions
K 7	types of gear cuts such as bevel, helical and straight
K 8	types of gear cases such as reduction, planetary and directional change
K 9	transmission and gear case components such as seals, bearings and gears
K 10	types of differentials such as hypoid, amboid and spiral bevel

K 11	differential applications
K 12	differential components such as bearings, bushings and seals
K 13	differential locking systems
K 14	transmission hydraulic systems

Sub-task

C-7.01 Repairs dry clutches.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

C-7.01.01	select and use tools and equipment such as floor jacks, specialized splitting stand and measuring tools according to application
C-7.01.02	disassemble equipment to remove clutch
C-7.01.03	disassemble clutch to determine wear limits
C-7.01.04	replace failed components such as release bearings, pilot bearings and clutch discs
C-7.01.05	assemble, install and align clutches according to OEM specifications
C-7.01.06	reassemble equipment according to OEM specifications

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Sub-task

C-7.02 Repairs driveline systems and components.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

C-7.02.01	select and use tools and equipment such as floor jacks and hand tools according to application
C-7.02.02	remove and disassemble components to determine service limits
C-7.02.03	replace failed components such as u-joints, yokes and steady bearings (hangers)

C-7.02.04 align and phase driveline systems and components such as sliding (slip) yokes and drive shafts

C-7.02.05 reassemble and reinstall components according to OEM specifications

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Sub-task

C-7.03 Repairs wet clutches, transmissions and gear cases.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

C-7.03.01 select and use tools and equipment such as floor jacks, specialized tools, transmission support stand and hand tools according to application

C-7.03.02 remove components such as cab, axle housings and wheels to access transmission

C-7.03.03 remove and disassemble transmission and gear cases to perform repairs such as reconditioning of clutches and replacement of gears according to OEM specifications

C-7.03.04 reinstall transmission and reassemble equipment according to OEM specifications

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Sub-task

C-7.04 Repairs differentials and final drives.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

C-7.04.01 select and use tools and equipment such as floor jacks, specialized tools, support stand and hand tools according to application

C-7.04.02 remove components such as axle housings and wheels to access differentials and final drives

C-7.04.03 remove and disassemble differentials and final drives

C-7.04.04 replace failed components of differentials and final drives such as bearings and bevel pinions gear set according to OEM specifications

C-7.04.05 assemble and install components according to OEM specifications

BLOCK D — HYDRAULIC, HYDROSTATIC AND PNEUMATIC SYSTEMS

Trends

On-board air compressors on equipment are becoming more common in some jurisdictions.

Hydraulic systems are becoming more sophisticated. They are also more compact and efficient.

Hydrostatics are a standard in the industry, and more pieces of equipment are being equipped with this system because of the infinite speed control.

Related Components (including, but not limited to)

Hydraulic: pumps, rock-shafts/three point hitch, cylinders, motors, actuators, fluids, controllers, wiring harnesses, valves.

Hydrostatic: motors, pumps, valves, controllers, oil coolers, lines and hoses, fittings, wiring harnesses.

Pneumatic: pumps, tanks, valves, air lines, actuators, accumulators, attenuators, dryers, air bags, air suspension, brake pots.

Tools and Equipment

See Appendix A.

Task 8 — Diagnoses hydraulic, hydrostatic and pneumatic systems.

Context

Agricultural equipment technicians must be able to understand the theory of hydraulics, hydrostatic and pneumatic systems. They need to differentiate whether the problem is electrical or hydraulic when doing diagnostics and use the proper testing equipment to help identify the problem.

Required Knowledge

K 1	basic theory and operating principles of hydraulic, hydrostatic and pneumatic systems
K 2	types and properties of hydraulic systems such as open-centre, closed-centre and blended
K 3	mechanically-controlled and electronically-controlled hydraulic and hydrostatic systems
K 4	hydraulic system components such as charge pumps, coolers, actuators and valves
K 5	sensor functions

K 6	fitting types and sizes
K 7	common faults such as chafed or broken hoses and leaks
K 8	hydrostatic system components such as pumps, motors, reservoirs, controls, sensors and gauges
K 9	safety bypass systems

Sub-task

D-8.01 Diagnoses hydraulic and hydrostatic systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

D-8.01.01	consult with customer or operator to identify symptoms of problem
D-8.01.02	determine whether power is being supplied to drive systems
D-8.01.03	perform sensory inspections to check for faults such as leaks, abnormal noises and heat
D-8.01.04	interpret hydraulic system schematics to determine system function and component location
D-8.01.05	select and use tools and equipment such as temperature measuring devices, flowmeters, pressure gauges and OEM special tools according to application
D-8.01.06	remove components such as panels, shields and hoods to access diagnostic area
D-8.01.07	perform pressure, flow and leak-off tests at operating temperature according to OEM specifications
D-8.01.08	interpret test results and compare to OEM specifications
D-8.01.09	determine required actions such as repairs, replacement or adjustment of pumps or valves, or further diagnoses

Sub-task

D-8.02 Diagnoses pneumatic systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

D-8.02.01	consult with customer or operator to identify symptoms of problem
D-8.02.02	verify power is being supplied to drive systems
D-8.02.03	perform sensory inspections to check for faults such as leaks and abnormal noises
D-8.02.04	interpret pneumatic system schematics to determine system function and component location
D-8.02.05	select and use tools and equipment such as pressure gauges and hand tools according to application
D-8.02.06	remove components such as panels, shields and hoods to access diagnostic area
D-8.02.07	perform pressure and time tests
D-8.02.08	interpret test results and compare to OEM specifications
D-8.02.09	determine required actions such as repairs, replacement or adjustment of compressors, valves and lines, or further diagnoses

Task 9 Repairs hydraulic, hydrostatic and pneumatic systems.

Context Agricultural equipment technicians must use the appropriate tools, measuring devices and procedures to return hydraulic, hydrostatic and pneumatic systems to OEM specifications.

Required Knowledge

K 1	basic theory and operating principles of hydraulic, hydrostatic and pneumatic systems
K 2	types and properties of hydraulic systems such as open-centre, closed-centre and blended
K 3	mechanically-controlled and electronically-controlled hydraulic and hydrostatic systems
K 4	hydraulic system components such as charge pumps, coolers, actuators and valves

K 5	sensor functions
K 6	fitting types and sizes
K 7	common faults such as chafed or broken hoses and leaks
K 8	hydrostatic system components such as pumps, motors, reservoirs, controls, sensors and gauges
K 9	safety bypass systems

Sub-task

D-9.01 Repairs hydraulic and hydrostatic systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

D-9.01.01	select and use tools and equipment such as hand tools and OEM special tools according to application
D-9.01.02	remove components such as panels, hoods and shields to access repair area
D-9.01.03	repair or replace hydraulic components such as hoses, pumps, valves, motors and actuators
D-9.01.04	adjust valves for pressure or flow according to OEM specifications
D-9.01.05	reassemble unit after repair according to OEM assembly instructions and procedures

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Sub-task

D-9.02 Repairs pneumatic systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

D-9.02.01	select and use tools and equipment such as hand tools and OEM special tools according to application
D-9.02.02	remove components such as panels, hoods and shields to access repair area
D-9.02.03	repair or replace pneumatic components such as hoses, fittings, compressors, valves and lines

D-9.02.04	adjust valves for pressure and operating height according to OEM specifications
D-9.02.05	reassemble unit after repair according to OEM assembly instructions and procedures

BLOCK E ELECTRICAL AND ELECTRONIC SYSTEMS

Trends	New technologies such as GPS controlled systems are being introduced to increase crop yield, reduce costs and decrease environmental impact and operator fatigue. Equipment is being equipped with International Standards Organization (ISO) standardized systems to allow system compatibility. There is a move from fuse and relay protected circuits to solid state control circuits.
Related Components (including, but not limited to)	**Electrical**: batteries, sensors, alternators, regulators, starting aid systems, wiring, relays, starters, cables, switches, solenoids, fuses, breakers, rotary beacons, block heaters, seat heaters, connectors, fusible links. **Electronic**: light emitting diodes (LEDs), modules, actuators, printed circuit boards, multi-function controls, data links, communication plugs, terminating resistors, controllers, sensors.
Tools and Equipment	See Appendix A.

Task 10 Diagnoses electrical/electronic power and control monitoring systems.

Context Electrical and electronic systems are integrated and support each other. These integrated systems are diagnosed together.

Required Knowledge

K 1	electrical subsystems such as starting and charging systems
K 2	electrical components such as batteries, actuators, alternators and switches
K 3	electronic components such as controllers, printed circuit boards and multi-function controls
K 4	equipment accessories and options such as GPS, data collection, automated steering and entertainment systems
K 5	integrated implement control systems and monitors
K 6	gauges of electrical wiring and types of connectors
K 7	basic electrical theory such as Ohm's law

K 8	electrical failures and faults such as corroded wires, poor grounds and bad connections
K 9	diagnostic procedures and flow chart interpretation
K 10	diagnostic resources such as dealer technical assistance

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Sub-task

E-10.01 Diagnoses electrical power and control monitoring systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

E-10.01.01	consult with customer or operator to identify symptoms of problems
E-10.01.02	operate equipment to reproduce symptoms
E-10.01.03	perform visual inspection on components such as batteries, fuses and relays for signs of damages such as corrosion, burnt components, broken wire connections and damaged harnesses
E-10.01.04	perform diagnostics such as circuit tests, component tests and service code diagnostics
E-10.01.05	remove components such as panels, seats and fuel tanks to access diagnostic area
E-10.01.06	select and use tools and testing equipment such as multi-meters, test lights, laptops and onboard diagnostic systems according to application
E-10.01.07	interpret schematics to locate components such as sensors and wiring
E-10.01.08	interpret results to determine required actions such as cleaning connections, replacing components, and soldering wires, or further diagnoses
E-10.01.09	interpret test results for the Controller Area Network (CAN) Bus systems

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Sub-task

E-10.02 Diagnoses electronic power and control monitoring systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

E-10.02.01	consult with customer or operator to identify symptoms of problems
E-10.02.02	operate equipment to reproduce symptoms

E-10.02.03	visually inspect components such as batteries, fuses, relays and CAN Bus components for signs of damage such as corrosion, burnt components, broken wire connections and damaged harnesses
E-10.02.04	gather diagnostic information by retrieving service codes and checking solid state controlled system
E-10.02.05	perform diagnostics such as circuit tests and component tests
E-10.02.06	remove components such as panels, seats and fuel tanks to access diagnostic area
E-10.02.07	select and use tools and testing equipment such as multi-meters, laptops and onboard diagnostic systems according to identified symptom such as service code and malfunction
E-10.02.08	interpret test results to determine required actions such as repairs, downloading software, replacing component and resetting according to OEM specification or further diagnoses

Task 11 Repairs electrical/electronic power and control monitoring systems.

Context Electrical and electronic systems are integrated and support each other. These integrated systems are repaired together.

Required Knowledge

K 1	electrical subsystems such as starting and charging systems
K 2	electrical components such as batteries, actuators, alternators and switches
K 3	electronic components such as controllers, printed circuit boards and multi-function controls
K 4	equipment accessories and options such as GPS, data collection, automated steering and entertainment systems
K 5	integrated implement control systems and monitors
K 6	gauges of electrical wiring and types of connectors
K 7	CAN Bus Theory of operation

Sub-task

E-11.01 **Repairs electrical power and control monitoring systems.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

E-11.01.01	select and use tools and equipment such as on-board diagnostics, electronic service tool (EST), OE specific tools and hand tools according to application
E-11.01.02	replace failed electrical components such as starters, solenoids and alternators
E-11.01.03	repair components such as connector pins and wires
E-11.01.04	repair harness assemblies by replacing damaged wires and connectors
E-11.01.05	reinstall components such as panels, seats and fuel tanks

Sub-task

E-11.02 **Repairs electronic power and control monitoring systems.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

E-11.02.01	select and use tools and equipment such as on-board diagnostics, electronic service tool (EST), and hand tools according to application
E-11.02.02	replace failed electronic components
E-11.02.03	perform corrective measures such as reprogramming, replacing and recalibrating components according to OEM specifications
E-11.02.04	reinstall components such as panels, seats and fuel tanks

BLOCK F — STEERING, SUSPENSION AND BRAKES

Trends

Electronic control steering, suspension and brake systems have become more efficient due to market demand. Electronic/GPS controlled steering is now used to save time and money for the operator.

The width and track pattern (foot print) of equipment is changing to provide less compaction and more traction.

Related Components (including, but not limited to)

Steering systems: hydraulic actuators, orbital steering pumps, tie rods, priority valves, controllers, sensors, hoses, hydraulic pumps, filters, seals, fittings.

Brake systems: hydraulic actuators, discs, brake valves, priority valves, seals, hoses, lines, hydraulic pumps, bleed screws, housings, pistons, controllers, sensors, fittings.

Wheels/tracks and track frames: bias and radial tires, rims, drive wheels, rubber tracks, support wheels, accumulators, actuators, pins, bushings, controllers, sensors, hubs, bearings, seals, frames.

Cushioning devices: fittings, hoses, controllers, sensors, air bags, shocks, accumulators, compressors, hydraulic pumps, valves, mounts, lines, actuators, springs.

Tools and Equipment

See Appendix A.

Task 12 — Diagnoses steering and brake systems.

Context

To operate equipment safely, steering and brake systems need to perform within operating parameters and according to OEM specifications. Agricultural equipment technicians perform diagnostic analyses to identify the cause of the failure.

Required Knowledge

K 1	steering and brake systems theory and operating principles
K 2	types of steering and brake systems such as hydraulic, mechanical and hydrostatic
K 3	steering system components such as hydraulic actuators, orbital steering pumps, tie rods and priority valves
K 4	steering and brake system component failures

K 5	allowable tolerances according to OEM specifications
K 6	parking brake systems
K 7	brake system components such as hydraulic actuators, discs, brake valves and priority valves

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Sub-task

F-12.01 Diagnoses steering systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

F-12.01.01	consult with customer or operator to identify symptoms of problems
F-12.01.02	perform sensory inspections on components such as steering motors, pumps and actuators for signs of leaks, binding, deformities and abnormal noises
F-12.01.03	remove components such as panels, hoods and tires to access diagnostic area
F-12.01.04	select and use tools and equipment such as pressure gauges, dial indicators and tape measures according to application
F-12.01.05	interpret schematics to isolate cause of failure
F-12.01.06	interpret results to determine required actions such as replacement, calibration and adjustment of components, or further diagnoses

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Sub-task

F-12.02 Diagnoses brake systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

F-12.02.01	consult with customer or operator to identify symptoms of problems
F-12.02.02	perform sensory inspections on components such as pads, rotors, valves and drums for signs of leaks, cracking, binding, heat points and abnormal noises
F-12.02.03	remove components such as panels, hoods and tires to access diagnostic area
F-12.02.04	select and use tools and equipment such as pressure gauges, dial indicators and vernier calipers according to application
F-12.02.05	interpret schematics to isolate cause of failure

F-12.02.06 disassemble brake system to access brake pads and cylinders

F-12.02.07 interpret results to determine required actions such as replacement, calibration and adjustment of components, or further diagnoses

Task 13 Repairs steering and brake systems.

Context To operate equipment safely, steering and brake systems need to perform within operating parameters. Agricultural equipment technicians repair steering and brake systems by removing, repairing, replacing, installing and adjusting various components of the equipment according to OEM specifications and recommendations.

Required Knowledge

K 1 steering and brake systems theory and operating principles

K 2 types of steering and brake systems such as hydraulic, mechanical and hydrostatic

K 3 steering system components such as hydraulic actuators, orbital steering pumps, and sensors

K 4 allowable tolerances according to OEM specifications

K 5 parking brake systems

K 6 brake system components such as hydraulic actuators, discs, brake valves and priority valves

K 7 types of materials of brakes such as bronze, fibre and brass

Sub-task

F-13.01 Repairs steering systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

F-13.01.01 select and use tools and equipment such as calipers, thermometers and impact wrenches according to application

F-13.01.02 replace steering components such as tie rod ends, steering rods and bushings according to OEM specifications

F-13.01.03	recondition components such as orbital steering pumps, priority valves and actuators according to OEM specifications
F-13.01.04	lubricate and adjust components such as setting toe-in and toe-out and steering stops according to OEM specifications

Sub-task

F-13.02 Repairs brake systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

F-13.02.01	select and use tools and equipment such as brake pliers, wrenches and brake bleeders according to application
F-13.02.02	replace brake components such as pads, rotors, drums, disc, pistons, plates and shoes
F-13.02.03	bleed and adjust brake system components such as master and wheel actuators (cylinders), and park brakes according to OEM specifications
F-13.02.04	recondition components such as linkages, brake valves, priority valves and brake actuators (cylinders) to OEM specifications
F-13.02.05	adjust components such as linkages, pedals and valves to OEM specifications
F-13.02.06	calibrate and adjust park brakes to OEM specifications

Task 14 Diagnoses suspension components.

Context The suspension on agricultural equipment allows for operator comfort, and helps improve traction and steering.

Diagnostic analysis is performed by agricultural equipment technicians to identify the cause of the component failure.

Required Knowledge

K 1	wheels/tracks and track frame theory and operating principles
K 2	wheel components such as bias tires, radial tires and rims
K 3	track and track frame components such as rubber tracks, support wheels and tensioning systems
K 4	wheels/tracks and track frame component failures

K 5	allowable tolerances according to OEM specifications
K 6	cushioning devices theory and operating principles such as suspended front axle
K 7	types of cushioning devices such as springs, accumulators, air bags and seats
K 8	cushioning device components such as fittings, hoses and sensors
K 9	cushioning component failures
K 10	safety procedures for inspection of components according to OEM recommendations

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Sub-task

F-14.01 Diagnoses wheels/tracks and track frames.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

F-14.01.01	consult with customer or operator to identify symptoms of problems
F-14.01.02	select and use tools and equipment such as jacks, hand tools, hoisting equipment and measuring devices according to application
F-14.01.03	perform checks such as measuring alignments and tension
F-14.01.04	perform sensory inspections to identify symptoms such as abnormal noises, wear and vibrations
F-14.01.05	interpret results to determine required actions such as repairs, component replacement, or further diagnoses

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Sub-task

F-14.02 Diagnoses cushioning devices.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

F-14.02.01	consult with customer or operator to identify symptoms of problems
F-14.02.02	select and use diagnostic tools and equipment such as pressure gauges, and adaptor fittings according to application
F-14.02.03	perform sensory inspections to identify faults such as leaks, cracks, tears and wear

F-14.02.04	perform checks such as testing for accumulator charge or failure
F-14.02.05	interpret results to determine required actions such as repairs, component replacement, or further diagnoses

Task 15 Repairs suspension components.

Context Suspensions are repaired to maintain operation of equipment, to minimize damage to other components and to reduce fatigue of the operator.

Required Knowledge

K 1	wheels/tracks and track frame theory and operating principles
K 2	wheel components such as bias tires, radial tires and rims
K 3	track and track frame components such as rubber tracks, support wheels and tensioning systems
K 4	cushioning devices theory and operating principles such as suspended front axle
K 5	types of cushioning devices such as springs, accumulators, air bags and seats
K 6	cushioning device components such as fittings, hoses and sensors
K 7	allowable tolerances and safety procedures for repair of components according to OEM specifications

Sub-task

F-15.01 Repairs wheels/tracks and track frames.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

F-15.01.01	select and use tools and equipment such as jacks, hand tools, hoisting equipment and measuring devices according to application
F-15.01.02	remove wheel components such as hubs, wedges and rims
F-15.01.03	remove tracks and disassemble track frame components such as idlers, mid rollers and pins
F-15.01.04	replace worn and damaged components such as fasteners, idlers, pins and bushings

F-15.01.05	recondition components such as tensioning devices and idlers to OEM specifications
F-15.01.06	align tensioning idlers on track systems
F-15.01.07	assemble and install components according to OEM specifications

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Sub-task

F-15.02 Repairs cushioning devices.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

F-15.02.01	select and use tools and equipment such as regulators, hand tools and jacks according to application
F-15.02.02	remove and recondition suspended front axles
F-15.02.03	remove and disassemble cushioning device components
F-15.02.04	replace damaged cushioning device components such as air bags, shocks and accumulators
F-15.02.05	recharge accumulator with nitrogen according to OEM specifications
F-15.02.06	assemble and install components according to OEM specifications

BLOCK G — STRUCTURAL COMPONENTS AND OPERATOR STATION

Trends

Plant based materials are being used in body panels as an eco-friendly practice. Waterborne paints are now standard. Regulations regarding the use of refrigerants are becoming more stringent. Using unregulated refrigerants is becoming more common resulting in the need to identify refrigerants before servicing.

Related Components (including, but not limited to)

Frame components: pivot points, frame rails, gussets, flanges, connecting members, sub-frames.

Equipment body: hoods, screens, shields, glass, tin work, roof, doors, hinges, seals, fenders, fire wall.

Heating and ventilation systems: heater cores, cab filters, air ducting, fans, controls.

Air conditioning systems: compressors, condensers, receiver-dryers, thermal expansion valves, orifice tubes, evaporators, hoses.

Tools and Equipment

See Appendix A.

Task 16 — Diagnoses structural components.

Context

The structural components on agricultural equipment enclose and support the operator and the equipment.

For safety purposes and operator comfort, agricultural equipment technicians perform sensory inspections to verify integrity of the structural components.

Required Knowledge

K 1	frame components such as pivot points, frame rails, gussets, flanges and connecting members
K 2	types and properties of metals
K 3	allowable tolerances according to OEM specifications
K 4	roll-over protective structure (ROPS)

K 5	equipment body components such as hoods, screens, shields, glass, tin work and roof
K 6	properties of materials such as metal, fibreglass and plastics

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Sub-task

G-16.01 Diagnoses frame components.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

G-16.01.01	select and use tools and equipment such as tape measures, levels and squares according to application
G-16.01.02	visually inspect structural components such as glass, frame, cab mounts and doors to identify faults such as cracks, fatigue and damage
G-16.01.03	consult technical drawings or factory assistance to verify dimensions according to OEM specifications
G-16.01.04	interpret results to determine required actions such as repairs, component replacement or further diagnoses

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Sub-task

G-16.02 Verifies condition of roll-over protective structure (ROPS).

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

G-16.02.01	select and use tools and equipment such as tape measures and squares according to application
G-16.02.02	consult technical drawings or factory assistance to verify dimensions according to OEM specifications
G-16.02.03	visually inspect to identify faults such as cracks, fatigue, and bent ROPS
G-16.02.04	interpret results to determine required actions such as component replacement or further diagnoses

Sub-task

G-16.03 Diagnoses equipment body.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

G-16.03.01	perform visual inspection to identify faults such as cracks, fatigue and loose fasteners
G-16.03.02	perform sensory inspections to identify faults such as air leaks, water leaks and cab noises
G-16.03.03	operate equipment to reproduce symptoms
G-16.03.04	interpret results to determine required actions such as repairs, component replacement or further diagnoses

Task 17 Repairs structural components.

Context Structural components require repair or replacement when they are damaged. Frame components must be at the OEM specifications to operate properly. Body equipment is restored for functional and aesthetic purposes. ROPS are not altered or repaired. Therefore, any failure results in a replacement.

Required Knowledge

K 1	frame components such as pivot points, frame rails, gussets, flanges and connecting members
K 2	types and properties of metals
K 3	reinforcement methods
K 4	ROPS
K 5	equipment body components such as hoods, screens, shields, glass, tin work and roof
K 6	properties of materials such as metal, fibreglass and plastics
K 7	bonding agents such as silicone, weather stripping glue and foam adhesive
K 8	auto body material such as body fill, fibreglass resin and primers

Sub-task

G-17.01 Repairs frame components.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

G-17.01.01	select and use tools and equipment such as torches, welders and hand tools according to application
G-17.01.02	remove and disassemble frame components
G-17.01.03	prepare frame components for repair using processes such as gouging, grinding and cutting
G-17.01.04	weld and cut frame components
G-17.01.05	fasten components by using methods such as bolting and plating
G-17.01.06	assemble and install frame components
G-17.01.07	prepare surface for painting by grinding, sanding and priming
G-17.01.08	paint frame components

Sub-task

G-17.02 Replaces roll-over protective structure (ROPS).

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

G-17.02.01	select and use tools and equipment such as hoisting equipment and hand tools according to application
G-17.02.02	remove components such as cab roof, doors and glass to access ROPS
G-17.02.03	install ROPS according to OEM specifications

Sub-task

G-17.03 Repairs equipment body.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

G-17.03.01	select and use tools and equipment such as hand tools, hoisting equipment and finishing tools according to application
G-17.03.02	remove and disassemble equipment body components
G-17.03.03	replace or recondition worn and damaged components such as hoods, roofs and fenders
G-17.03.04	replace components such as hinges, brackets and glass
G-17.03.05	weld and cut body components
G-17.03.06	prepare surface for painting by grinding, sanding and priming
G-17.03.07	paint body components

Task 18 Diagnoses climate control systems.

Context Climate control systems maintain interior cab temperature to optimize comfort as requested by the operator.

Diagnostic analyses are performed by agricultural equipment technicians to identify the cause of the malfunction in the climate control system.

Required Knowledge

K 1	heating and ventilation systems theory and operating principles
K 2	heating and ventilation components such as heater core, cab filters and air ducting
K 3	heating and ventilation component failures such as noisy fans, leaking heater cores and burnt resistors
K 4	air conditioning systems theory and operating principles
K 5	air conditioning components such as compressors, condensers, receiver-dryers, thermal expansion valves, evaporators and hoses
K 6	air conditioning component failures such as ruptured hoses, failed compressors and cracked cores
K 7	types of refrigerants such as R-12/R134a and refrigerant blends

K 8	jurisdictional regulations concerning refrigerants
K 9	safety risks pertaining to unregulated refrigerants

Sub-task

G-18.01 Diagnoses heating and ventilation systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

G-18.01.01	consult with customer or operator to identify symptoms of problems
G-18.01.02	select and use diagnostic tools and equipment such as temperature gauges and multi-meters according to application
G-18.01.03	check components such as dampers, thermostats and water pumps for faults such as improper heat levels and improper air flow
G-18.01.04	perform sensory inspections to identify faults such as odours, plugged heater cores and air leaks
G-18.01.05	interpret results to determine required actions such as repair, component replacement or further diagnoses

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Sub-task

G-18.02 Diagnoses air conditioning systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

G-18.02.01	consult with customer or operator to identify symptoms of problems
G-18.02.02	select and use diagnostic tools and equipment such as thermometers, pressure gauges, refrigerant identification tester and leak detection tools according to application
G-18.02.03	check components such as thermostats, condensers and evaporators
G-18.02.04	perform sensory inspections to identify faults such as temperature variances, abnormal noises and leaks

G-18.02.05	operate the system to test system pressures
G-18.02.06	interpret results to determine required actions such as repair, component replacement or further diagnoses

Task 19 Repairs climate control systems.

Context Agricultural equipment technicians repair climate control systems by adjusting, repairing or replacing components.

Required Knowledge

K 1	heating and ventilation systems theory and operating principles
K 2	heating and ventilation components such as heater core, cab filters and air ducting
K 3	air conditioning systems theory and operating principles
K 4	air conditioning components such as compressors, condensers, receiver-dryers, thermal expansion valves, evaporators and hoses
K 5	effects of external temperatures on air conditioning operating principles

Sub-task

G-19.01 Repairs heating and ventilation systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

G-19.01.01	select and use tools and equipment such as hand tools and vacuum cleaners according to application
G-19.01.02	remove components such as cab roof, seats and floor mats to access repair area
G-19.01.03	remove and disassemble heating and ventilation components
G-19.01.04	perform repairs such as cleaning, replacement and calibration on components such as fans, resistors, motors, valves and heater cores
G-19.01.05	assemble and install heating and ventilation components according to OEM specifications

Sub-task

G-19.02 Repairs air conditioning systems.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

G-19.02.01	select and use tools and equipment such as pressure gauges, recovery devices, vacuum pumps and hand tools according to application
G-19.02.02	identify and recover refrigerant according to jurisdictional regulations
G-19.02.03	remove components such as panels, cab roof, seats and floor mats to access repair area
G-19.02.04	replace faulty air conditioning components such as compressors, clutches and evaporators
G-19.02.05	assemble and install air conditioning components according to OEM specifications
G-19.02.06	recharge the system with refrigerant according to OEM specifications

BLOCK H AGRICULTURAL EQUIPMENT

Trends

While the basic principles of agricultural equipment are similar, each brand is developing new technology. Often the diagnostics, adjustments and repairs are brand-specific and non-transferable. Accordingly, there is an increase in in-house training and manufacturer-specific training.

Crop diversification, new equipment, new technologies, use of electronics and specialized software require agricultural equipment technicians to broaden their range of skills.

There is an increase in farming trends to straight cut harvesting from swathing, resulting in more repairs to straight-cut headers. In some regions, zero till or low tillage operations are becoming more common, with a reduction of work on tillage equipment. For irrigation, above ground canals are being converted to underground piping to reduce evaporation.

Agricultural equipment has become automated and GPS guided. This technology reduces input cost and operator fatigue.

Related Components (including, but not limited to)

Land preparation tools: harrows, sub-rippers, brush cutters, rock rakes, rock pickers, land levellers.

Tillage implements: chisel plows, discs, tandem discs, cultivators.

Seeding implements: air seeders, air drills, planters, hoe drills.

Harvesting equipment: combines, swathers, harvesters.

Forage and hay equipment: round and square balers, mower conditioners, forage harvesters, wheel rakes, swath turners, hay tedders, headers, rakes, hay preservative applicators.

Application equipment: sprayers, spreaders, granular applicators.

Irrigation equipment: pumps, reels, plumbing, controllers.

Delivery equipment: grain carts, bale grinders, mixers, augers, elevators, conveyors.

Tools and Equipment

See Appendix A.

Task 20 — Prepares agricultural equipment.

Context Agricultural equipment technicians assemble and install equipment according to OEM specifications. They adjust the equipment to fit the use and operating need of the customer.

Required Knowledge

K 1	types of agricultural equipment such as combines, tractors, swather units, high-clearance sprayers and forage harvesters
K 2	types of implements such as balers, headers, seeding and tillage equipment, and rakes
K 3	types of components such as loaders, three-point hitches and air packages
K 4	classes of drive lines such as 540 and 1000
K 5	hydraulic and electric connections and adapters
K 6	adjustments for clearances, speed and conditions according to the types of crops
K 7	ballasting requirements
K 8	torque procedures
K 9	hydraulic flow and pressure specifications

Sub-task

H-20.01 **Performs assembly and pre-delivery adjustments on agricultural equipment.**

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

H-20.01.01	select and use tools and equipment such as lifting equipment and power and hand tools according to application
H-20.01.02	assemble individual components or implements to create finished piece of equipment according to OEM specifications
H-20.01.03	verify assembly completion by checking parts list and requested options
H-20.01.04	ballast equipment to ensure optimal power transfer
H-20.01.05	verify that items on OEM checklist have been completed to satisfaction

Sub-task

H-20.02 Installs agricultural equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

H-20.02.01	prepare surfaces for proper fit by cleaning grinding and buffing to remove rust and paint
H-20.02.02	verify proper implements and components according to horsepower rating and use
H-20.02.03	locate power sources on equipment to activate control unit
H-20.02.04	attach implements such as balers, headers and mowers to equipment according to OEM specifications
H-20.02.05	select and use tools and equipment such as hand, power and measuring tools according to application

Task 21 - Diagnoses land preparation, tillage and seeding/planting implements.

Context Farming practices, soil conditions and crop selection affect land preparation and tillage implements and seeding/planting requirements. Agriculture equipment technicians must understand these conditions, as well as the implement characteristics, to be able to diagnose failures. Visual acuity is important for both alignment and levelling of the equipment. Technicians must be up-to-date on the latest developments of seeding and tillage practices.

Required Knowledge

K 1	operations of land preparation and tillage implements and operating systems
K 2	drafting of implements
K 3	pin connections and wiring harnesses
K 4	types of tillage and land preparation implements
K 5	hazards associated with treated seeds, chemicals and fertilizers
K 6	operations of seeding and planting implements and their operating systems
K 7	types of seeding, fertilizing and planting implements
K 8	depth and metering control units

K 10	types of packers such as rubber and steel
K 11	opener spacing
K 12	types of hydraulic system requirements
K 13	horsepower requirements
K 14	types of crops

Sub-task

H-21.01 Diagnoses land preparation and tillage implements.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

H-21.01.01	consult with customer or operator to identify symptoms of problems
H-21.01.02	interpret schematics to isolate cause of failure
H-21.01.03	perform visual inspection on components such as actuators, frames and linkages for signs of leaks, and bent, missing or warped components
H-21.01.04	select and use hand tools and diagnostic tools and equipment according to application
H-21.01.05	inspect common wear points to determine components to be replaced
H-21.01.06	verify tire pressure
H-21.01.07	check draft by measuring implements' offset according to OEM specifications
H-21.01.08	interpret results to determine required actions such as repair, component replacement, calibration, and adjustment, or further diagnoses

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Sub-task

H-21.02 Diagnoses seeding and planting implements.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

H-21.02.01	consult with customer or operator to identify symptoms of problems
H-21.02.02	interpret schematics to isolate cause of failure

H-21.02.03	perform visual inspection on components such as hoses, clutches and metering devices for signs of leaks, and bent, missing or warped components
H-21.02.04	select and use tools such as hand tools, diagnostic tools, gauges and multimeters according to application
H-21.02.05	check for faulty wiring harnesses, connectors and sensors such as air velocity, speed and bin level
H-21.02.06	verify monitor settings to confirm seeding and planting operation
H-21.02.07	verify hydraulic function to confirm seeding and planting operation
H-21.02.08	measure seed depth and uniformity by performing a seed bed inspection
H-21.02.09	inspect common wear points to determine components to be replaced
H-21.02.10	test pressures such as tire, hydraulic, vacuum and air flow
H-21.02.11	check seeding and planting implements for level to verify operation
H-21.02.12	calibrate seeding implement to determine application rate by weighing and calculating density of product
H-21.02.13	interpret results to determine required actions such as repair, replacement, calibration and adjustment, or further diagnosis

Task 22 — Repairs land preparation, tillage and seeding/planting implements.

Context Agricultural equipment technicians repair and adjust tillage and seeding/planting implements to minimize operational cost and optimize performance of the equipment, depending on soil conditions and crop type, and according to customer needs and preferences.

Required Knowledge

K 1	operations of land preparation and tillage implements and their operating systems
K 2	types of land preparation and tillage implements such as cultivators, sub-soilers and disks
K 3	land preparation and tillage implements drafting
K 4	operations of seeding and planting implements and their operating systems
K 5	types of seeding and planting implements such as air drills, planters and broadcast spreaders
K 6	seeding and planting implement drafting
K 7	depth and metering control units
K 8	types of packers such as rubber and steel

K 9	welding procedures
K 10	types of crops

Sub-task

H-22.01 Repairs land preparation and tillage implements.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

H-22.01.01	select and use tools and equipment such as hand and power tools according to application
H-22.01.02	remove and disable components such as actuators and linkages to access repair area
H-22.01.03	adjust level and tire pressures according to OEM specifications
H-22.01.04	perform basic welding repairs to restore to OEM specifications
H-22.01.05	replace components such as shanks, sweeps, bearings and shafts
H-22.01.06	adjust level stops mechanically and hydraulically

Sub-task

H-22.02 Repairs seeding and planting implements.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

H-22.02.01	select and use tools and equipment such as hand and power tools according to application
H-22.02.02	remove components such as covers and shields to access repair area
H-22.02.03	adjust level and tire pressures according to OEM specifications
H-22.02.04	rebuild metering parts such as metering wheels, metering rolls, augers and planter disks
H-22.02.05	replace metering components such as bearings, brushes, bushings and scrapers
H-22.02.06	replace seed bed preparation and finishing wear items such as tips, disks and packers
H-22.02.07	replace seed distribution hoses and tubes

H-22.02.08	set sensors such as velocity, speed and rate according to OEM specifications
H-22.02.09	adjust air plenums and dampers according to OEM specifications

Task 23 Diagnoses harvesting, hay and forage equipment.

Context This equipment collects, processes and delivers crops and products. To improve the operation and functioning of the equipment, technicians should understand the principles of harvesting, hay and forage equipment.

Required Knowledge

K 1	operations of cutting and conditioning equipment and operating systems
K 2	operations of delivery, gathering and processing equipment, and operating systems
K 3	types of cutting and conditioning equipment such as sickles, rotary disks, rollers and flails
K 4	types of crops
K 5	equipment usage according to different crops and crop conditions
K 6	operation of knife register and angle
K 7	wear tolerances of components such as guards and knife hold-downs
K 8	reel position and finger timing
K 9	types of gathering equipment such as balers, headers and forage harvesters
K 10	precision agricultural equipment such as yield, moisture and guidance
K 11	types of processing equipment such as combines, feeders, dryers and mixers
K 12	types of delivery equipment such as grain carts and high-dump wagons

Sub-task

H-23.01 Diagnoses cutting, conditioning, gathering and processing equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

H-23.01.01	consult with customer or operator to identify symptoms of problems
H-23.01.02	select and use diagnostic tools and equipment according to application

H-23.01.03	perform sensory inspections on components such as rollers, knives, threshing elements and tines for signs of wear, damage, misalignment and for abnormal noises
H-23.01.04	remove components such as shields and drive lines to access diagnostic area
H-23.01.05	interpret schematics to isolate cause of failure
H-23.01.06	verify monitor and implement settings to match crop type
H-23.01.07	interpret results to determine required actions such as repair, component replacement , calibration and adjustment or further diagnoses

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Sub-task

H-23.02 Diagnoses delivery equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

H-23.02.01	consult with customer or operator to identify symptoms of problems
H-23.02.02	perform sensory inspection on component such as belts, bearings, chains, conveyors and auger flighting for signs of wear, damage, misalignment and abnormal noise
H-23.02.03	select and use diagnostic tools and equipment according to application
H-23.02.04	interpret schematics to isolate cause of failure
H-23.02.05	remove components such as shields, covers and belts to access diagnostic area
H-23.02.06	interpret results to determine required repairs, component replacement, calibration and adjustment, or further diagnoses

Task 24 — Repairs harvesting, hay and forage equipment.

Context Agricultural equipment technicians adjust harvesting, hay and forage equipment according to customer needs and preferences. The technician must perform repairs to optimize the performance of the equipment and to minimize operational costs and down time for the customer.

Required Knowledge

K 1	operations of cutting, gathering, processing, delivery and conditioning equipment, and operating systems
K 2	types of cutting and conditioning equipment
K 3	types of crops
K 4	wear tolerances of components such as guards and knife hold-downs
K 5	types of gathering equipment such as balers, headers, and forage harvesters
K 6	types of processing equipment such as combines, feeders, dryers, bale processors and mixers
K 7	types of delivery equipment such as grain carts, and high-dump and silage wagons

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Sub-task

H-24.01 Repairs cutting, conditioning, gathering and processing equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

H-24.01.01	select and use tools and equipment such as hand, power and measuring tools according to application
H-24.01.02	remove components such as shields, belts and pulleys to access repair area
H-24.01.03	replace components such as bearings, belts, threshing elements and chains according to OEM specifications
H-24.01.04	recondition components such as gear cases, rollers, knives, threshing elements and guards according to OEM specifications

H-24.01.05	prepare surface to weld damaged components and to restore structure to OEM specifications
H-24.01.06	align or adjust equipment such as knife and finger timing, belt and, chain tension, and drive sheaves according to OEM specifications and crop conditions

Sub-task

H-24.02 Repairs delivery equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

H-24.02.01	select and use tools and equipment such as hand, power, welding and measuring tools according to application
H-24.02.02	recondition components such as gear cases, auger flightings and shafts to OEM specifications
H-24.02.03	replace components such as bearings, belts, chains and auger flightings
H-24.02.04	prepare and weld damaged components to restore structural integrity to OEM specifications
H-24.02.05	align or adjust equipment such as belt and chain tension, and drive sheaves according to OEM specifications and crop conditions

Task 25 Diagnoses application and irrigation equipment.

Context Application and irrigation equipment applies product to help produce greater crop yield and lower disease. Agricultural equipment technicians diagnose application and irrigation equipment to identify failures and faults.

Required Knowledge

K 1	sprayer supporting systems such as pumps, agitation systems, chemical management systems and flow rating systems
K 2	types of spraying equipment such as pull-type and self-propelled
K 3	precision agricultural components for uses such as mapping, documentation, application rate and guidance

K 4	common faults of spraying and irrigation equipment such as plugged strainers, nozzles, solenoids and damaged pumps
K 5	type and size of sprayer and irrigation nozzles
K 6	chemical types of pesticides, herbicides and fungicides
K 7	safety procedures and hazards associated with using spraying and granular application equipment
K 8	theory and operations of sprayer, granular application and irrigation equipment
K 9	granular application equipment operating systems such as agitation systems, rating systems and delivery chain systems
K 10	types of granular application equipment such as pull-type, self-propelled and hitch mounted
K 11	common failures of granular application equipment such as worn chains, shafts and bearings
K 12	irrigation equipment operating components such as pumps, reels and piping
K 13	types of irrigation equipment

Sub-task

H-25.01 Diagnoses application equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

H-25.01.01	consult with customer or operator to identify symptoms of problems
H-25.01.02	perform visual inspections on components such as gear cases, flow meters and booms for signs of leaks, damage and structural deformities
H-25.01.03	perform sensory inspections on components such as hydraulic and hydrostatic pumps and motors, and engines
H-25.01.04	select and use diagnostic tools and equipment according to application
H-25.01.05	check fluids for levels and contamination
H-25.01.06	interpret schematics to isolate cause of failure
H-25.01.07	remove components such as panels and covers to access diagnostic area
H-25.01.08	calculate flow, volume, distance, weight, speed and pressure
H-25.01.09	verify monitor settings such as rate controller, flow meters, boom calibration and air velocity

H-25.01.10	check wear points such as pivot points and pads for wear
H-25.01.11	interpret results to determine required actions such as repairs, component replacement, calibration and adjustment, or further diagnoses

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Sub-task

H-25.02 Diagnoses irrigation equipment. (Not Common Core)

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	no	no	ND	yes	yes	no	yes	NV	ND	ND	ND

Key Competencies

H-25.02.01	consult the customer or operator to identify symptoms of problems
H-25.02.02	perform visual inspection on components such as gear cases, pipes, nozzles and pumps for signs of leaks, plugging and deformities
H-25.02.03	perform sensory inspection on components such as engines, pumps and irrigation lines
H-25.02.04	select and use diagnostic tools and equipment according to application
H-25.02.05	calculate application rate, volume, speed and pressure by matching pump output and nozzle diameter
H-25.02.06	interpret results to determine required actions such as repairs and component replacement, calibration and adjustment, or further diagnoses

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Task 26 Repairs application and irrigation equipment.

Context Agricultural equipment technicians adjust application and irrigation equipment to optimize performance. Technicians repair defective application and irrigation system components. They must be aware of potential hazards associated with chemicals and organic waste processed with this equipment.

Required Knowledge

K 1	spraying equipment supporting systems such as pumps, agitation systems, chemical management systems and flow rating systems
K 2	types of spraying and granular equipment such as pull-type and self-propelled
K 3	precision agricultural components such as mapping, documentation, application rate and guidance

K 4	type and size of sprayer and irrigation nozzles
K 5	chemicals types such as pesticides, herbicides and fungicides
K 6	safety procedures and hazards associated with working with granular application, spraying and irrigation equipment
K 7	theory and operations of spraying, granular application and irrigation equipment
K 8	granular application equipment operating systems such as agitation systems, rating systems and delivery chain systems
K 9	types of granular application equipment such as pull-type, self-propelled and hitch mounted
K 10	irrigation equipment operating components such as pumps, reels and piping
K 11	types of irrigation methods such as flood, manual, wheel move and pivot
K 12	types of irrigation equipment such as pumps, motors and pipes

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Sub-task

H-26.01 Repairs application equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	ND	yes	yes	yes	yes	NV	ND	ND	ND

Key Competencies

H-26.01.01	select and use tools and equipment such as hand, power and measuring tools according to application
H-26.01.02	decontaminate sprayers to neutralize residue from the previous product
H-26.01.03	set equipment by aligning and levelling components according to OEM specifications and crop conditions
H-26.01.04	adjust rate controller for volume, distance, speed, pressure, weight and flow for optimal performance
H-26.01.05	prepare surface to weld damaged components and to restore structure to OEM specifications
H-26.01.06	recondition components such as gear cases, pumps, motors, valves and actuators by replacing packings and seal kits according to OEM specifications
H-26.01.07	replace and calibrate flow meters, pressure senders and switches to meet OEM specifications
H-26.01.08	replace components such as sprayer nozzles and strainers

Sub-task

H-26.02 Repairs irrigation equipment. (Not Common Core)

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	no	no	ND	yes	yes	no	yes	NV	ND	ND	ND

Key Competencies

H-26.02.01	select and use tools and equipment such as hand, power and measuring tools according to application
H-26.02.02	set equipment by aligning and levelling components according to OEM specifications and crop conditions
H-26.02.03	prepare surface to weld damaged components and to restore structure to OEM specifications
H-26.02.04	recondition components such as gear cases, pumps, motors and valves by replacing packings and seal kits according to OEM specifications
H-26.02.05	replace components such as nozzles, impellers and piping
H-26.02.06	adjust rate controller for volume, speed, pressure and rate according to OEM and customers' specifications

APPENDICES

APPENDIX A — TOOLS AND EQUIPMENT

Hand Tools

Allen wrench
bushing, bearing and seal driver sets
chisels
crimpers
crow foot
electrical terminal tool kit
extractor
files
fin comb
hone set (flexible cylinder hone)
hammers
inspection lights and mirrors
magnetic pick-up tools
pick sets
pliers
probe lights
pry bars
punches
saws
screwdrivers
socket sets
tire gauges
wire strippers
wrenches

Power Tools

air die grinder
air hammers
air ratchets
air wrenches
blow gun
cut-off saw
drills
grinder
grinding wheels
horizontal bandsaw
lighting devices (trouble lights, flood lights)
sanders
soldering iron/gun
pressure washer
presses
vacuum cleaner

Measuring, Testing and Diagnostic Equipment

air conditioning test gauges
air-conditioning test equipment kits
alternator test stands
antifreeze testers
battery load testers
borescope
circuit continuity testers
compression test kit
computer engine analyzers
computer interface connector
coolant/battery testers
cylinder liner service tool kit
depth micrometers
diagnostic receptacles
dial calipers
diesel fuel injection nozzle testers
digital/mechanical pressure test gauges
dynamometer

Measuring, Testing and Diagnostic Equipment (continue)

electronic control circuit diagnostic testers
electronic leak detectors
feeler gauges
flow meter kits (analog/digital)
fuel consumption meter
hole gauges
hydrometer
ignition analyzers
infrared temperature sensors
in-line hydraulic testers
inside/outside micrometers
laptop computer
manometers
multimeters (analog/digital)
non-contact heat gun
outside calipers
plastigage
power shift transmission test kits
pressure test kits
radiator pressure tester and pressure pumps
refrigerant identifiers
ring groove wear gauges
rubber stoppers/leak detector kits
rulers
spark testers
sprayer nozzle tester
spring compression tester
squares
starting/charging analyzers
stop watches
straight-edges
tachometer (digital photo/strobe light)
tape measure
taper gauges
telescoping gauge sets
temperature readers
timing tools
torque angle gauge
torque wrenches
transmission services and adjusting tools
vacuum pump kits
verniers

Shop Equipment

battery chargers
belt lacing tools
C-frame presses
degreasing and steam cleaning equipment
dowel pullers
drill press
thread repair kits
hose crimpers
hydraulic service benches
hydraulic hose assembly equipment
hydraulic pumps
hydraulic rams
hydraulic shop presses
lathe
lube bucket pumps
lubrication and oiling equipment
open throat presses
painting equipment
parts washers and brushes
pin bushing drivers
post-lock pullers
puller sets and components
recovery and recycling equipment (fuel, oil, antifreeze)
ring compressors
ring expanders
ring groove cleaners

Shop Equipment (continue)

rivet presses
roll bed shop presses
rotary hand pumps
service trucks
slide hammers
starting and charging analysers
tube and pipe bending and flaring tools
vices
water pump service tools
work benches

Specialty Tools and Equipment

air-conditioning fitting kits (with tees, caps, reducers, elbows, tubes, adapters)
camshaft service tools
compressor specialty tools
differential/final drive and axle specialty tools
flushing equipment kits
hydrostatic drive specialty tools
injection pump service tools
nitrogen accumulator charging kits
nozzle service tools, nozzle pullers
oil evacuators
oil transfer units (with or without vacuum pump or filtration unit)
refrigerant evacuation pumps
refrigerant reclaiming and recovery equipment
valve spring depressors/compressors
valve magnetic follower holder kits
valve refacers
valve reseating tool kits
valve seat cutters
valve seat grinders

Hoisting, Lifting and Staging Equipment

A-frames
blocking
engine repair stands with component adapter sets
hoisting equipment
holding fixtures
hydraulic jacking system (air/electric)
hydraulic ram jacks
lift trucks
load positioning sling
mobile floor cranes
overhead cranes
service jacks with special adapters
support stands
tractor splitting stands
wheel and axle lifts

Welding and Cutting Equipment

electric arc welding and cutting equipment (with power supply, welding machine, electrode holder, ground clamps)

Metal-arc Inert Gas (MIG) welder

oxy-acetylene welding/cutting equipment (with cylinders, pressure regulators, welding torch, hoses)

plasma cutting (with electrical current and air, hoses, welders)

Personal Protective Equipment and Safety Equipment

aprons

carbon monoxide sensors
coveralls
dust masks
ear plugs
emergency shower
exhaust ventilation
eye wash station
face shields
fall protection system
fire blanket
fire extinguisher
first aid kit
gloves (chemical, welding, latex, nitrile, heavy duty)
goggles
guard rails
hearing protection
hard hats
masks
respirators
safety boots
safety glasses
vehicle lock-out systems (tags and locks)
wheel chocks
welding curtain
welding personal protective gear

APPENDIX B GLOSSARY

ballast	the placement of metal or liquid weight on a machine for both traction and lifting to ensure proper weight distribution.
base engine	assembled block and head including internal components and gear trains.
driveline	the connection between a power source and a driven component.
drive train	the mechanically driven components, from the flywheel to the ground, that receives power, torque and speed from the engine to create movement (of the machine).
electrical systems	starting, charging, lighting and accessory circuits without computer control modules.
electronic systems	electrical systems operated via computerized electronic control modules and related sensors and wiring.
hay preservative	option for hay processing equipment, specifically balers, that allows the operator to bale product at higher moisture content without spoilage.
headers	device, attached and powered by a harvester or traction unit, used to gather crop from field.
hydrostatic system	a hydraulic system which uses fluid under pressure to transmit power through tubes or hoses to machine drive components such as wheel or track drives. It provides infinite speed at a finite pressure.
implement	a towed piece of machinery controlled from the traction unit.
precision agricultural equipment	systems allowing the operator to guide and control machinery, map an area, vary rates and eliminate overlaps or misses. The equipment includes a global positioning system, yield monitors, moisture meters, and guided steering.
staging equipment	approved stands or mounts used to support equipment so it can be disassembled without damage or personal injury.
structural component	a component that supports as well as allows equipment to retain its rigidity.

suspension systems that support the main frame and other components which dampens shock load from the ground and may include cabs, booms, belts, track frame, axle and wheel assemblies.

APPENDIX C ACRONYMS

API	American Petroleum Institute
CAN	Controller Area Network Bus
CARB	California Air Research Board
CV	Constant Velocity
CVT	Continuously Variable Transmissions
DEF	Diesel Exhaust Fluid
DOC	Diesel Oxidation Catalyst
DPF	Diesel Particulate Filter
EGR	Exhaust Gas Recirculation
EPA	Environmental Protection Agency
EST	Electronic Service Tool
GPS	Global Positioning System
ISO	International Standards Organization
IVT	Infinite Variable Transmissions
LED	Light Emitting Diodes
MIG	Metal-arc Inert Gas
MSDS	Material Safety Data Sheet
OEM	Original Equipment Manufacturer
OH&S	Occupational Health and Safety
PPE	Personal Protective Equipment
ROPS	Roll-over Protective Structure
SAE	Society of Automotive Engineers
SCR	Selective Catalytic Reduction

TDG	Transport of Dangerous Goods
WHMIS	Workplace Hazardous Materials Information System

APPENDIX D — BLOCK AND TASK WEIGHTING

BLOCK A OCCUPATIONAL SKILLS

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	NV	6	5	5	ND	5	4	6	8	NV	ND	ND	ND	5%

Task 1 Performs safety-related functions.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	25	30	40	ND	20	20	35	30	NV	ND	ND	ND	29%

Task 2 Performs common work practices and procedures.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	43	40	30	ND	50	40	45	40	NV	ND	ND	ND	41%

Task 3 Uses and maintains tools and equipment.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	32	30	30	ND	30	40	20	30	NV	ND	ND	ND	30%

BLOCK B ENGINES AND ENGINE SUPPORT SYSTEMS

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	NV	15	12	15	ND	20	15	13	15	NV	ND	ND	ND	15%

Task 4 Diagnoses engine and engine support systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	40	60	65	ND	60	65	72	60	NV	ND	ND	ND	60%

Task 5 Repairs engine and engine support systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	60	40	35	ND	40	35	28	40	NV	ND	ND	ND	40%

BLOCK C DRIVE TRAIN

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	NV	12	13	15	ND	15	13	9	12	NV	ND	ND	ND	13%

Task 6 Diagnoses drive train.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	40	60	65	ND	60	65	70	60	NV	ND	ND	ND	60%

Task 7 Repairs drive train.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	60	40	35	ND	40	35	30	40	NV	ND	ND	ND	40%

BLOCK D HYDRAULIC, HYDROSTATIC AND PNEUMATIC SYSTEMS

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	NV	18	18	15	ND	15	20	23	15	NV	ND	ND	ND	18%

Task 8 Diagnoses hydraulic, hydrostatic and pneumatic systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	60	60	65	ND	60	70	70	70	NV	ND	ND	ND	65%

Task 9 Repairs hydraulic, hydrostatic and pneumatic systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	40	40	35	ND	40	30	30	30	NV	ND	ND	ND	35%

BLOCK E ELECTRICAL AND ELECTRONIC SYSTEMS

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	NV	20	17	25	ND	25	20	23	18	NV	ND	ND	ND	21%

Task 10 Diagnoses electrical/electronic power and control monitoring systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	70	70	70	ND	75	80	75	80	NV	ND	ND	ND	74%

Task 11 Repairs electrical/electronic power and control monitoring systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	30	30	30	ND	25	20	25	20	NV	ND	ND	ND	26%

BLOCK F STEERING, SUSPENSION AND BRAKES

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	NV	10	10	10	ND	8	8	9	5	NV	ND	ND	ND	8%

Task 12 Diagnoses steering and brake systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	20	30	30	ND	40	40	32	55	NV	ND	ND	ND	35%

Task 13 Repairs steering and brake systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	30	25	20	ND	30	25	20	20	NV	ND	ND	ND	24%

Task 14 Diagnoses suspension components.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	20	25	30	ND	20	25	28	15	NV	ND	ND	ND	23%

Task 15 Repairs suspension components.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	30	20	20	ND	10	10	20	10	NV	ND	ND	ND	18%

BLOCK G STRUCTURAL COMPONENTS AND OPERATOR STATION

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	NV	6	10	5	ND	5	8	6	7	NV	ND	ND	ND	7%

Task 16 Diagnoses structural components.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	10	20	25	ND	20	15	20	15	NV	ND	ND	ND	18%

Task 17 Repairs structural components.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	20	20	25	ND	10	10	20	15	NV	ND	ND	ND	17%

Task 18 Diagnoses climate control systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	35	30	40	ND	45	35	35	40	NV	ND	ND	ND	37%

Task 19 Repairs climate control systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	35	30	10	ND	25	40	25	30	NV	ND	ND	ND	28%

BLOCK H AGRICULTURAL EQUIPMENT

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	NV	13	15	10	ND	7	12	11	20	NV	ND	ND	ND	13%

Task 20 Prepares agricultural equipment.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	17	30	20	ND	5	5	10	10	NV	ND	ND	ND	14%

Task 21 Diagnoses land preparation, tillage and seeding/planting implements.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	18	10	25	ND	20	15	18	18	NV	ND	ND	ND	18%

Task 22 Repairs land preparation, tillage and seeding/planting implements.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	13	10	10	ND	10	10	13	10	NV	ND	ND	ND	11%

Task 23 Diagnoses harvesting, hay and forage equipment.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	14	20	25	ND	25	25	17	25	NV	ND	ND	ND	21%

Task 24 Repairs harvesting, hay and forage equipment.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	13	20	10	ND	20	15	13	15	NV	ND	ND	ND	15%

Task 25 Diagnoses application and irrigation equipment.

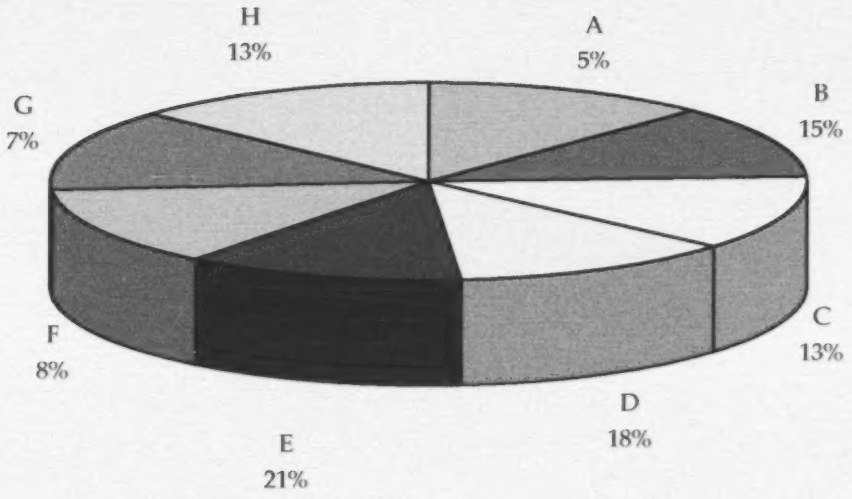
	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	14	5	5	ND	10	20	17	15	NV	ND	ND	ND	12%

Task 26 Repairs application and irrigation equipment.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	11	5	5	ND	10	10	12	7	NV	ND	ND	ND	9%

APPENDIX E

PIE CHART*



TITLES OF BLOCKS

BLOCK A	Common Occupational Skills	BLOCK E	Electrical and Electronic Systems
BLOCK B	Engines and Engine Support Systems	BLOCK F	Steering, Suspension and Brakes
BLOCK C	Drive Train	BLOCK G	Structural Components and Operator Station
BLOCK D	Hydraulic, Hydrostatic and Pneumatic Systems	BLOCK H	Agricultural Equipment

*Average percentage of the total number of questions on an interprovincial examination, assigned to assess each block of the analysis, as derived from the collective input from workers within the occupation from all areas of Canada. Interprovincial examinations typically have from 100 to 150 multiple-choice questions.

APPENDIX F

TASK PROFILE CHART — Agricultural Equipment Technician

BLOCKS	TASKS	SUB-TASKS				
A – COMMON OCCUPATIONAL SKILLS	1. Performs safety-related functions.	1.01 Uses personal protective equipment (PPE) and safety equipment.	1.02 Maintains safe work environment.			
	2. Performs common work practices and procedures.	2.01 Conducts operational tests.	2.02 Maintains fluids, lubricants and coolants.	2.03 Services filters.	2.04 Maintains hoses, tubing and fittings.	2.05 Services bearings/ bushings and seals.
		2.06 Uses fasteners, sealing devices, adhesives and gaskets.	2.07 Cleans components.	2.08 Verifies equipment and components repairs.	2.09 Plans daily tasks.	2.10 Performs failure analysis.
	3. Uses and maintains tools and equipment.	3.01 Maintains tools and equipment.	3.02 Uses hoisting, lifting and securing equipment.	3.03 Uses computers diagnostics and programming.		
B - ENGINES AND ENGINE SUPPORT SYSTEMS	4. Diagnoses engine and engine support systems.	4.01Diagnoses base engine.	4.02 Diagnoses lubrication system.	4.03 Diagnoses cooling system.	4.04 Diagnoses intake and exhaust system.	4.05 Diagnoses fuel delivery system.
		4.06 Diagnoses engine management systems.	4.07 Diagnoses emissions control systems.			

BLOCKS	TASKS	SUB-TASKS				
	5. Repairs engine and engine support systems.	5.01 Repairs base engine.	5.02 Repairs lubrication system.	5.03 Repairs cooling system.	5.04 Repairs intake and exhaust system.	5.05 Repairs fuel delivery system.
		5.06 Repairs engine management systems.	5.07 Repairs emissions control systems.			
C - DRIVE TRAIN	6. Diagnoses drive train.	6.01 Diagnoses dry clutches.	6.02 Diagnoses driveline systems and components.	6.03 Diagnoses wet clutches, transmissions and gear cases.	6.04 Diagnoses differentials and final drives.	
	7. Repairs drive train.	7.01 Repairs dry clutches.	7.02 Repairs driveline systems and components.	7.03 Repairs wet clutches, transmissions and gear cases.	7.04 Repairs differentials and final drives.	
D - HYDRAULIC, HYDROSTATIC AND PNEUMATIC SYSTEMS	8. Diagnoses hydraulic, hydrostatic and pneumatic systems.	8.01 Diagnoses hydraulic and hydrostatic systems.	8.02 Diagnoses pneumatic systems.			
	9. Repairs hydraulic, hydrostatic and pneumatic systems.	9.01 Repairs hydraulic and hydrostatic systems.	9.02 Repairs pneumatic systems.			
E - ELECTRICAL AND ELECTRONIC SYSTEMS	10. Diagnoses electrical/ electronic power and control monitoring systems.	10.01 Diagnoses electrical power and control monitoring systems.	10.02 Diagnoses electronic power and control monitoring systems.			
	11. Repairs electrical/ electronic power and control monitoring systems.	11.01 Repairs electrical power and control monitoring systems.	11.02 Repairs electronic power and control monitoring systems.			

BLOCKS	TASKS	SUB-TASKS		
F. –STEERING, SUSPENSION AND BRAKES	12. Diagnoses steering and brake systems.	12.01 Diagnoses steering systems.	12.02 Diagnoses brake systems.	
	13. Repairs steering and brake systems.	13.01 Repairs steering systems.	13.02 Repairs brake systems.	
	14. Diagnoses suspension components.	14.01 Diagnoses wheels/tracks and track frames.	14.02 Diagnoses cushioning devices.	
	15. Repairs suspension components.	15.01 Repairs wheels/tracks and track frames.	15.02 Repairs cushioning devices.	
G - STRUCTURAL COMPONENTS AND OPERATOR STATION	16. Diagnoses structural components.	16.01 Diagnoses frame components.	16.02 Verifies condition of roll-over protective structure (ROPS).	16.03 Diagnoses equipment body.
	17. Repairs structural components.	17.01 Repairs frame components.	17.02 Replaces roll-over protective structure (ROPS).	17.03 Repairs equipment body.
	18. Diagnoses climate control systems.	18.01 Diagnoses heating and ventilation systems.	18.02 Diagnoses air conditioning systems.	
	19. Repairs climate control systems.	19.01 Repairs heating and ventilation systems.	19.02 Repairs air conditioning systems.	

BLOCKS	TASKS	SUB-TASKS	
H - AGRICULTURAL EQUIPMENT	20. Prepares agricultural equipment.	20.01 Performs assembly and pre-delivery adjustments on agricultural equipment.	20.02 Installs agricultural equipment.
	21. Diagnoses land preparation, tillage and seeding/planting implements.	21.01 Diagnoses land preparation and tillage implements.	21.02 Diagnoses seeding and planting implements.
	22. Repairs land preparation, tillage and seeding/planting implements.	22.01 Repairs land preparation and tillage implements.	22.02 Repairs seeding and planting implements.
	23. Diagnoses harvesting, hay and forage equipment.	23.01 Diagnoses cutting, conditioning, gathering and processing equipment.	23.02 Diagnoses delivery equipment.
	24. Repairs harvesting, hay and forage equipment.	24.01 Repairs cutting, conditioning, gathering and processing equipment.	24.02 Repairs delivery equipment.
	25. Diagnoses application and irrigation equipment.	25.01 Diagnoses application equipment.	25.02 Diagnoses irrigation equipment. **(NOT COMMON CORE)**
	26. Repairs application and irrigation equipment.	26.01 Repairs application equipment.	26.02 Repairs irrigation equipment. **(NOT COMMON CORE)**